Relationality and health: developing a transversal neurotheological account of the pathways linking social connection, immune function, and health outcomes

Patricia H Bennett (2013)

Relationality and Health

Developing a transversal neurotheological account of the pathways linking social connection, immune function, and health outcomes

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A dissertation submitted to the University of Oxford Brookes in partial fulfilment of the requirements of the degree of Doctor of Philosophy

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May 2013

Abstract

This thesis is a transdisciplinary investigation of the link between social connection and health outcomes. Its twofold aim is to explore the nature of this relationship and build a theoretical model for a possible causal chain between the two, and to develop and deploy a new model for engaging the very different discourses of theology and neuroscience. To this end it draws on both theological reflection and on experimental scientific data from cognitive neuroscience and psychoneuroimmunology.

The opening half of the work establishes the wider epistemological and methodological frameworks within which the project is set, and also the specific framework for the particular area of study. The first of these involves a critical analysis of the tensions at the heart of the dialogue between science and religion, and of the specific difficulties faced by the emerging sub-discipline of neurotheology. It then dissects and further develops the interdisciplinary dialogical model devised by J Wentzel van Huyssteen, in order to enable it to generate and support additional *trans*disciplinary outputs. In the second of the two framework arenas, the concept of health itself is first explored, and then epidemiological, Biblical, and immunological accounts of the link between relational connection and health are examined in order to establish that sufficient common ground exists to warrant a neurotheological approach to investigating the question of how the two are connected.

The second half of the thesis then uses the developed model as a basis for engaging theological and neuroscientific perspectives on human relationality. This takes the form of three transversal encounters, each centred around a specific aspect of this: relationality as *basic*, as *emergent*, and as *realised*. From the output of these three dialogical interactions, a neurotheologically framed argument is developed to support the contention that relationality is an emergent phenomenon of a complex system concerned with social monitoring and response, and thus the way in which it is realised can exert causal constraints on system components. Finally a theoretical model is derived from this argument for a pathway linking relational experience to health outcomes via alterations in allostatic maintenance mechanisms

Acknowledgements

Many friends and colleagues have contributed in various ways to this endeavour; however I particularly wish to record my heartfelt thanks to my supervisors, Dr Dominic Corrywright, and Dr Martin Groves, for the unfailing help, encouragement, and support – both academic and pastoral – which they have provided over the course of my studies. I am similarly indebted to Professor William Gibson of Oxford Brookes University, and to Dr Richard Snook, Emeritus Professor of Analytical Science at the University of Manchester, for their expressions of confidence, their words of wisdom, and for helpful comments on the text; likewise thanks are due to several of my fellow-members of the Institute on Religion in an Age of Science and the European Society for the Study of Science and Theology, whose challenging questions pushed me on to greater bravery in my academic quest.

I am also deeply grateful to my three children for both keeping me grounded and believing in my ability to fly; and I wish especially to thank my daughter Ellie, who undertook the mammoth job of proof-reading this thesis with diligence and humour, and who also offered some insightful comments on the arguments presented in it.

Finally I wish to dedicate this work to my father, the late Rev. Anthony Bennett, who always encouraged me to ask questions, introduced me to the pleasures of poetry, and showed me that it is never too late to embark on totally new ventures and adventures.

Contents

Introduction

Aims and challenges

> We live in a world that has been made precise; in this world only what can be precisely calculated, presented, measured, and made available counts as real.[1]
>
> (Janke, 1999:12)

> We are still in the pre-history of the human mind. Only complex thought will allow us to civilise our knowledge.
>
> (Morin, 2008:6)

> Nothing will unfold for us unless we move toward what looks to us like nothing: faith is a cascade[2].
>
> (Fulton, 2001:2)

The human propensity for exploration, technological advances enabling us to do this in new ways, and the rapid dissemination facilitated by the communications revolution, have left us increasingly inundated with data. Information does not however equate to knowledge, and this deluge has merely served to heighten an escalating problem whose roots go back to Descartes' *Rules for the Direction of the Mind, viz.* that of progressive fragmentation and hyper-specialisation within disciplines and departments. Simultaneously, the capacity and ability to integrate the resulting specialised data across these heightened boundary divisions is declining – not just due to their sheer volume, but also because of the underlying *Weltenschauung* itself. The problem has been compounded by the ongoing disjunction – also with Cartesian roots – between the humanist and scientific cultures. Against the accompanying rise of Janke's '*praecisio mundi*', this has seen the explorations and outputs of the former discounted by the latter as a valid contribution to objective knowledge about the world, with a consequent contraction and impoverishment of understandings. A pressing question we currently face is thus how to approach the task of reconnecting this ever increasing volume of in-

[1] *'Wir leben in einer präzisierten Welt; in ihr wird nur noch das als wirklich gegeben zugelassen, was präzise berechnet, hergestellt, abgemessen, verfugbar gemacht werden kann.'* Personal translation courtesy of Dr F Mortenson.
[2] Poem: 'Cascade Experiment'

formation: how do we build knowledge in a way which recognises and responds not just to the inherent complexity of the natural world investigated by the sciences, but also to the ever present and increasing complexity of human lived reality, as explored and articulated by the humanities?

These concerns regarding the adequacy of current epistemological and integration strategies for delivering this complex knowledge form the backdrop to the current project. At first sight, the field of science-religion would seem to be perfectly placed to undertake this kind of reconnection, and indeed to be doing fairly well at it. However, as I discuss in Chapter 1, this perception is open to question. Epistemological parity through shared critical realism, though confidently claimed, is not generally accepted outside of the field. Moreover even within it, the accompanying declarations of bidirectional flow and mutual expansion are difficult to substantiate, with theology inevitably the recipient rather than the donor of insight. In effect then, there is a question mark as to whether such engagement has generated any widely accepted expansion of knowledge of the kind envisaged here, or whether it is irrevocably caught in an apologetic cul-de-sac. For those who believe not only in the inherent rationality of the theological enterprise, but also in its ability to produce genuine knowledge about the world, this represents a frustrating state of affairs.

This thesis thus has two main objectives, one tied to each of its twin research hypotheses that:

1. Relationality[3] is an emergent phenomenon of a complex system involved in social signal decoding and response, and the way in which it is expressed and experienced can directly affect health.

2. A dialogue between theology, psychoneuroimmunology, and cognitive neuroscience can both optimise understanding of the nature of this connection, and facilitate the exploration of possible underlying mechanisms.

In the first instance the objective is to explore the well documented link between social connection and health, particularly the possibility of an immunological pathway for this; and with regard to the second, to develop and test an alternative way of engaging scientific and theological understandings, in which both disciplines contribute as equal and accepted parties to produce an expanded under-

[3] The neologism is used throughout the thesis to refer to the human capacity to form and sustain relational connections with others.

standing of a particular issue. To do this requires finding an alternative to critical realism as the locus of parity and to this end, as discussed in Chapter 2, I further develop the transversal model devised by J Wentzel van Huyssteen (1999; 2006) and predicated on his refiguring of rationality. The proposed extension offers a mechanism for generating and facilitating non-reductive conversations, in which theology's wealth of rationally developed anthropological insights can engage with those of the neurosciences to expand and deepen our understanding of human relationality and its potential health consequences.

In the ensuing transversal collaborations, theological thinking on various aspects of personhood and relational connection are brought together with raw experimental data from social cognitive neuroscience (CGNS) and psychoneuroimmunology (PNI) to build a model for connecting relationality and health via immune signalling pathways. However as I discuss in Chapters 1 and 2, whilst this very different dialogical route holds great potential, it also presents very particular challenges to, and for, the theological contribution: firstly, is it possible to make the necessary case in each instance that the proffered theological understandings are not only rational, but also do not require a concomitant assent to specific religious propositions (one of the chief difficulties for science-religion engagement *outside* of the dedicated field)? Secondly, can this be done without eviscerating their content of everything which makes it distinctively theological and thus reducing it to the 'devalued coinage' and 'anaemic myth' feared by Westhelle (2000:165-72)? Addressing such questions is also a major part of the project.

The form in which the dissertation is presented is thus somewhat different from that of a typical humanities thesis for two key reasons, one practical and one philosophical. With respect to the first, the appeal to three distinctly different disciplinary fields means that a large and very disparate volume of literature is drawn on; thus the standard form of reviewing all the literature as a forerunner to presenting and developing the thesis themes and arguments is clearly inappropriate: to do so would require several preliminary chapters of data discussion with insufficient context to give sense or sustain interest. Moreover, the adoption of a new methodological approach, the background to the topic itself, and the issue of emergence which forms a central part of the argument, all also necessitate specific reviews to establish suitable baselines for the project work. The way I have

elected to approach this aspect is therefore to use the opening literature chapter to present an overview of the issues facing the science-religion dialogue generally, and the hybrid discipline of neurotheology specifically. Chapter 2 then dissects and discusses van Huyssteen's dialogical model and the new extension I am proposing, along with their underpinning philosophy. These two chapters thus establish the main framework for the project. Chapter 3 then moves the focus to the specific transversal project, reviewing epidemiological and PNI data, along with Biblical perspectives on relationality and health, as a way of establishing that sufficient ground exists to attempt the proposed neurotheological exploration. Thereafter in Chapters 4, 5, and 6, I introduce, review, and discuss the specific scientific data and the key theological ideas on a chapter by chapter basis, with the philosophical and scientific challenges of emergence forming an extended prolegomenon to this in the case of Chapter 5. Hence in a sense the literature review is also gradually unfolded across the course of the thesis. However this allows each tranche of data to be presented in a way which roots it in a specific aspect of the unfolding argument, thus anchoring it in the necessary context for making sense of its place in the whole. In Chapter 6, after the final transversal collaboration, I draw the outputs from all three of these chapters together to produce a composite neurotheologically informed argument. Finally I use this as the basis for developing a theoretical, transversally derived, model for a pathway linking social connection and health outcomes via the mechanisms regulating allostatic balance.

Connecting the scientific data, theological reflection, and specific dimensions of a complex composite argument in this way also serves the second reason for the differently shaped presentation. Here the primary aim has been to unfold and present the thesis argument in a way which reflects the transversal methodology underpinning it. Thus just as Descartes' *Discourse on Method*, or Reich's recent monograph on relational and contextual reasoning (Reich, 2002), are written in a style which itself also expresses and illustrates the content of the thesis it presents, so in constructing this work as a series of specifically delineated transversal encounters, each giving rise to its own peculiar outcome, which then interlock to build a composite argument, I have endeavoured to also illustrate the key metrics of both the transversal philosophy undergirding the enquiry, and the mechanics of the dialogical model which it supports.

This format has also allowed me to fulfil the model's postfoundational 'epistemic contract' whilst also illustrating its versatility. With regard to the former there are, as I discuss in Chapter 2, certain requirements for the selection and use of material for the proposed transversal integrations. Thus an important part of each of Chapters 4, 5, and 6 has been to establish that there is a sufficient point of intersection between the scientific and theological contributions; to discuss the experimental difficulties and inferential limitations of the former; and with the latter to demonstrate that they have been formulated in a way which satisfies the criteria for claiming postfoundational rationality at work. With respect to the issue of versatility, each of the three chapters has been used to integrate the scientific and theological material in a different way. Thus in Chapter 4, CGNS and theology form mutually interlocking support on an issue where legitimate challenges can be raised against the accounts of both; in Chapter 5, theology, PNI, and CGNS each supply a different strand of evidence towards the chapter argument; and finally in Chapter 6, PNI and theology provide the obverse and reverse of the evidential coin – the former from the cellular and the latter from the cognitive level. Similarly each chapter has allowed me to focus on a different aspect of how/why theological material might be suitable for this kind of engagement – for example because of the way the ideas have been developed over time in response to changing understandings, or because of the way a particular author themselves handles the exploratory quest.

However the format also presents some particular challenges for both reader and writer. Reading requires a degree of accommodative flexibility as each chapter covers a large amount of often vastly different ground. This sees them segueing from fMRI scans, cellular function, or immune signalling to 4th century philosophical theology, the theodramatics of von Balthasar, or the theatrical dramatics of Marcel, via such things as epidemiology, complex systems, process metaphysics, and allostatic maintenance! I have attempted to strike a reasonable balance between sufficient supporting explanation for the non-specialist reader and inappropriate simplification for the level of the work. Alongside this issue of range, the potential vastness of the territories to be covered and the complexity of many of their features have also furnished a presentational challenge. This has necessitated an approach involving maximum abstraction and compression. In the theological case particularly, the issue has been compounded by the need to present

extended justifications for selection alongside the actual material itself. In each instance, and for each contributing voice, I have tried to delineate some major contours and features as they pertain to the project issues and indicate where further, more expanded accounts of debates alluded to can be found; and also to demonstrate that both the scientific data and the theological concepts have been treated with respect and properly engaged with, despite the compressed end-point presentations. This is particularly important in light of a number of issues which I discuss in Chapters 1, 4, and 5: firstly, because concepts such as social trinitarianism and emergence, by their very nature, lend themselves to having ideas and agendas projected onto them rather than derived from them; and secondly, because of problems not only to do with how *theology* has sometimes appropriated scientific data/ideas, but also with how *science* can sometimes overextend the inferences which can legitimately be drawn from its data, and of the speed with which some of these unwarranted inferences then become incorporated into the received wisdom of both fields.

Finally, there has been the challenge of adequately balancing the various voices in a way which reflects the basic premise that theology and science contribute on equal terms to the development of the thesis arguments, but also that the wider project has a distinctive and distinctly theological purpose. During the course of its development, what began life as a primarily theologically orientated PhD underwent a fairly radical transformation into a much more transdisciplinary – or rather *transversal* – venture. In this, not only has the *way* in which the theology been used become radically different from that originally envisaged, but it has also become only one of three contributing voices. Nevertheless it is still in an important sense a theology PhD, originating from and conducted within a theology department rather than a neuroscientific one, and primarily concerned to advance a case that theological thought has much to contribute, alongside that of science, to expanding our understanding of the world, and particularly of human experience within it. Thus whilst relatively speaking, the theological voice may appear to be overpowered, this is an artefactual effect. In fact within the chapters, each participating voice has equal weight as regards the chapter percentage dedicated to it; and as the chapter structures and arguments make clear, each makes its own distinct contribution to the cumulative transversal argument. To further avoid the suggestion that the theology (or indeed PNI or CGNS) is reduced

to a second order reflection, I have also varied the order in which the material is presented, allowing factors peculiar to chapter purpose and content to determine which leads off in any particular case

As will become clear, the theological material in the project, whilst drawn exclusively from within Christianity, is not presented from a confessional standpoint. However in deference to a long-standing personal sensibility, I have capitalised the words God, Jesus, Holy Spirit and Trinity, although not the cognates of the latter. When referring to God I have used conventional masculine pronouns for consistency and clarity, but this does not imply that a specifically gendered conception of God is necessary for understanding or appropriating the material. I have also used capitalisation for the words 'Other', 'Presence', and 'Mystery' to distinguish where these are used as conceptual markers – as for example in the thought of Marcel. In view of the multidisciplinary nature of the work, occasional explanations of terminology or mechanisms have been necessary. I have supplied these in the form of footnotes to avoid excessive parenthetical disruption of the text, and to save the reader having to look up terms in an appendix and thus break their reading flow. With a further view to aiding clarity, I have also adopted the convention of the Oxford comma throughout the thesis.

Three very different publications have resulted so far from this work and these are presented in the appendix: *Towards a Neurotheology of Health* (Bennett, 2009:297-334) is a paper presented at the 2008 Metanexus Conference and subsequently one of the conference papers selected for publication in the journal *Transdisciplinarity in Science and Religion*. As a very early iteration of the project, it now stands as indication of the subsequent metamorphosis of this from an inter- to trans-disciplinary endeavour. *Supple and Subtle* (Bennett, 2012:175-96) is an essay discussing critical realism as a methodological strategy through an examination of the writings of John Polkinghorne, and was published in the Festschrift marking his 80th birthday. Finally, *Life beyond Critical Realism* (Bennett, In Press) is a paper discussing my development of van Huyssteen's model which was presented at the 2012 ESSSAT conference, and which will be published in the forthcoming volume of *Issues in Science and Theology.*

A finished PhD will always appear to its author as something of a palimpsest bearing the ghostly marks of a thousand re-writes, and trailing the memory of all the

discarded sketches and maquettes which preceded them. Hand in hand with this is an inevitable sense of frustration that the finished piece is, as Steiner has it, 'an inevitably reductive, diminished articulation of far richer [...] possibilities' and one which leaves behind and unfulfilled 'the unbounded intuitions of the workshop' (Steiner, 2001:110). I am acutely aware here of a huge gulf between the possibilities and the end product – something which is in part due to embarking on a project whose complexity, as became increasingly apparent, far exceeded my initial naïve estimations, and which no amount of Procrustean manoeuvres could reduce to fit into the allowed space. I am also very conscious of venturing into a territory of huge complexity which has taken me well beyond any previous medical or scientific competencies, and of doing so on the basis of simply a hunch and with a far from standard map for exploring the possibilities! In this respect, the lines from Fulton's poem seem peculiarly apt, and its motifs of unfolding in the light of *movement towards*, even more pertinent and poignant given the subject matter of human relationality.

Encounter, Exchange, & Expression

Exploring and expanding the contours of engagement

> "Where the place?"
>
> Shakespeare (Macbeth I, i)

> For those who wish to get clear of difficulties it is advantageous to discuss the difficulties well; for the subsequent free play of thought implies the solution of the previous difficulties, and it is not possible to untie a knot of which one does not know.
>
> Aristotle (Metaphysics III, i)

> And as imagination bodies forth
> The forms of things unknown, the poet's pen
> Turns them to shapes and gives to airy nothing
> A local habitation and a name.
>
> Shakespeare (A Midsummer Night's Dream V, i)

1.1 Introduction and outline

Any creative engagement, whether between individuals, artistic modes or disciplinary discourses, is governed by an implicit threefold metric of encounter, exchange, and expression: where, and around what nexus is interaction to be situated? In what manner is it to be facilitated and regulated? Finally, in what form are any resulting progeny to be 'bodied forth', and for what purpose? The choices and manoeuvres of the three are, moreover, woven together in a web of mutual influence and effect; and underpinning both the parts and the whole is the critical question of '*why?*' The story of engagement between science and religion is thus not merely one of attention to specific issues such as creation or divine action in the world, but concurrently also the history of the various attempts to address the enormous challenges enfolded within this triple dynamic.

The appearance of neurotheology stands as one testimony to these endeavours, but simultaneously, the enterprise itself graphically displays in microcosm the difficulties necessitating such efforts. This is amply illustrated in Newberg's recent efforts to decisively delineate the field and set out various pointers to govern and

direct its endeavours. The resulting *Principles of Neurotheology* (Newberg, 2010), through its attempts to identify appropriate grounds of enquiry, establish the nature and purpose of a 'neurotheological' approach to these, and determine the shape of possible outcomes, brings into sharp focus some of the key problems underlying science-religion engagement generally. It also clearly illustrates the difficulties which must be negotiated if the embryonic discipline of neurotheology is to mature into a significant participant in this. Moreover, whilst each of the elements of the dynamic of engagement highlighted above pose specific issues for the development of a coherent account of neurotheology, Newberg arguably fails to resolve these, and thus a question mark still hangs, not only over what neurotheology actually *is,* but also whether, and in what way, this nascent discipline can contribute to the wider field of science-religion interaction. It is the contention of this thesis that neurotheology can be more fruitfully conceptualised in terms of a transdisciplinary venture rather than as an uneasy hybridised neo-discipline. This shift, in conjunction with the establishment of clear objectives and the employment of a suitably rooted, robust, and imaginative methodology, opens up a very different way of engaging theological and neurobiological perspectives which enables some of these difficulties to be negotiated. This in turn paves the way for the generation of a coherent and distinctive discourse which can both take a legitimate place in the engagement between science and religion, and also offer a valuable contribution to its ongoing quest to more fully elucidate what it is to be human.

The analyses of the current chapter represent, in response to Aristotle's injunction, the laying bare of the knots which must be unravelled before this proposed neurotheological investigation can be undertaken. Since these have roots in the parent field of science/religion, the examination begins from this wider locus and looks at three areas of tension. As I have already suggested, the question '*why?*' underpins any attempt at constructive engagement and raises distinctive issues in each of these arenas. If neurotheological dialogue is to prosper and develop coherently both the question and the attendant implications of how it is answered must be grappled with. It is also intertwined in assorted ways with other tensions between the two discourses. These epistemological and ontological issues are well-rehearsed in the literature and here are addressed *tout court* as a way to in-

dicate the sort of difficulties which must be negotiated in the neurotheological arena.

The focus then shifts to neurotheology itself and to an exploration of its contours and dynamics. This is done through an engagement with the protagonists of its initial and current phases – theologian James Ashbrook and neuroscientist Andrew Newberg respectively. Ashbrook's neurotheology, developed across a wide range of papers and two key books (Ashbrook, 1984a; Ashbrook and Albright, 1997), is essentially an attempt to develop a 'unified field theory' of mind, brain, self, world, and God which draws on neuroscientific research, (Albright, 2010:483; Ashbrook, 1996b:480). However it rarely features in current discourse, the recent retrospective in Zygon (Albright, 2010:479-489) notwithstanding. Newberg's own experimental neurotheological work has primarily focussed on brain activity during religious practice (e.g. d'Aquili and Newberg, 1999; Newberg and Lee, 2005). However he has written extensively outside of this base and his name is now prominently, if not always positively (Graf, 2007:260), associated with the discipline. Moreover both its formal delineation in the *Encyclopedia of Religion* and the subsequent description of the potential field given there (Newberg, 2005:6492-5), are predominantly a reflection of his (and the late Gene d'Aquili's) interests, perspectives, and empirical work.

In keeping with the chapter's theme of the purpose and mechanics of engagement, the aim in both cases is not to offer detailed critiques of the actual *content* of Ashbrook's and Newberg's own neurotheological output, but instead to consider how each defines and approaches the task of neurotheology. In Ashbrook's case, I examine some of the problems associated with the development of his 'humanizing brain' thesis and their implications for the construction of other neurotheologies. With Newberg, I address the overall vision for neurotheology articulated in his recent *Principia.* For the purposes of the current chapter the focus of the critique is on three specific aspects relevant to its theme: the need to both delimit and specify the field of enquiry, the importance of clear objectives for any exchange, and the necessity of employing a robust methodology which can generate and sustain a coherent discourse.

Finally, in the light of the critiques offered, I briefly sketch the possibility of an alternative 'transversal' approach to neurotheological engagement which I propose

to employ in this study. This draws on the twin concepts of postfoundational rationality and transversal space dialogue developed by J Wentzel van Huyssteen (1998a; 1999) and subsequently used as the foundation for his 2004 Gifford Lectures interfacing theology and paleoanthropology (van Huyssteen, 2006). As regards the dynamics of encounter I suggest that his methodology provides a way of addressing and potentially overcoming some of the difficulties which are discernable in both Ashbrook's and Newberg's approaches; with respect to those of exchange and expression, I propose that a further development of his transversal space model offers a radically different way of marrying theological insight with neuroscientific data. As I will argue in the following chapter, this both allows the negotiation of some of the identified difficulties which have beset neurotheology and provides a new possibility for how to 'body forth' the fruits of any exchange in a way which is both distinctively and coherently neurotheological. This model, its underpinning philosophical stance, and the proposed extension will then be fully laid out and developed in Chapter 2.

1.2 Engaging scientific and religious perspectives

Any attempted vignette of the connection between science and religion immediately runs into a difficulty: there is, as historian John Brooke observed in his nuanced and meticulous commentary on the matter, simply 'no such thing as *the* relationship between religion and science' (Brooke, 1991:321). As a wide variety of studies indicate (e.g. Brooke, 1991; Brooke and Cantor, 1998; Livingstone, 2003; Numbers, 2006), both scientific and religious discourses, and the intersections between them, are all highly contextualised. Thus blanket theses about the contours of interaction between them are difficult to sustain (Brooke, 1991:5). Nevertheless, the caveat duly noted, it is necessary to make some general observations about the current state of the field and its programs and ambitions; and about certain underlying tensions between the two discourses, particularly as these have a bearing on the development of neurotheology. As with all aspects of science/religion engagement, such tensions are complex in nature and resist simplistic reduction. However, for the purposes of this discussion I want to consider these under three broad categories – purpose, epistemological strategies, and ontological understandings – and these will be dealt with in the following three subsections.

Initially though I want to highlight a further general issue which is particularly germane to this study in a number of ways: The primary locus of engagement between science and religion has tended to be around religious discourse as claims about reality (Drees, 2010:61). However this cognitive-propositional dimension represents only one element of the complex matrix subsumed under the label 'religion' - experiential and traditional elements are also significant carriers of religious content (see Drees, 1996:24-49; Lindbeck, 1984). Of course it is also true, as Southgate (2011:13) notes, that science too has its imaginative, aesthetic, and traditional elements – though this fact tends to be suppressed or even denied in the context of science/religion engagement. From the perspective of this study though, it is the religious side of this which is of concern here, and from two respects: firstly, religious statements about the nature of reality tend, either overtly or implicitly, to come attached to other propositional or dogmatic frameworks and this raises various problems for both 'encounter' and 'exchange' which I will discuss further below. One of the aims of this study will be to explore whether and how theological insights can be used in dialogue with neuroscience without this entailing either a concomitant assent to the faith propositions attached to the framework within which they are generated, or an evisceration of anything which renders them distinctively *theological*. Secondly, whilst acknowledging the validity of developing engagements which reach beyond the cognitive dimension of religion, the current emphasis in neurotheology on imaging studies of religious practice and experience raises interesting and vital questions as to the identity and purpose of neurotheology, and its differentiation from a more reductive neuroscientific study of religion, which must be addressed. I will return to this in section 3.

1.2.1 An ambiguous academic adventure?

Whilst engagement between scientific and religious perspectives on the world has a long timeline in the history of human thought, the formal discipline has a much shorter pedigree. However over the last 50 years the science/religion field has become a recognised and stable academic discipline (Clayton, 2008:1), generating innumerable books, papers, and conferences. This is due in no small part to the imaginative, disciplined, and pellucid efforts of prominent first generation scholars to grapple with the issues of appropriate location, methodology, and articulation. Nevertheless, the successful establishment of academic Chairs, study cen-

tres, and prestigious peer-reviewed journals notwithstanding, certain tensions remain deeply embedded at the heart of the engagement, and with them important questions about the nature of the enterprise itself. Furthermore, a certain unease surrounding both ongoing dialogue in established areas, and the appearance of new hybrids such as neurotheology, continues to be expressed from both scientific and theological camps (e.g. Atkins, 2006:124; Helminiak, 2010:47-74).

Alongside these residual tensions regarding purpose, and organically related to their lack of decisive resolution, are legitimate questions as to the wider impact of the science/theology exchange, both generally and on its contributing disciplines. There is an interesting and suggestive discrepancy between Browning's perception that

> From almost every angle of vision, particularly when viewed from the perspective of the success of *Zygon* itself, the science-and-religion discussion is strong and vital (Browning, 2007:821).

and Drees' more sombre assessment that:

> consensus on issues of importance seems far away, the impact on theology and on religious communities is limited and the academic credibility of 'religion and science' remains marginal (Drees, 2010:2).

But whilst the latter makes for uncomfortable reading, it is by no means unsupported. Many theologians have taken little or no interest in such dialogue (Knight, 2001:1-3; Polkinghorne, 2008:xi-xiii), while Smedes (2007:596-7) notes not only the lack of mention of its outputs in any recent systematic theologies, but also believes the discipline to have become closed and introspective – essentially an end in itself, rather than a means to a wider end.

From the scientific perspective, a similar lack of academic engagement and discussion from outside of the field should also be noted. There are no critiques of assorted attempts at 'bodying forth' the fruits of science/religion in journals outside the specialist ones, and those offered in the popular press and blogosphere tend to be hostile and derogatory: scientists unconnected with the field tend to regard explanations of resurrection in terms of information transfer, or of godly action via quantum physics – even when produced by distinguished scientists such as Polkinghorne – as at best an embarrassing aberration, and at worst a completely illegitimate and distorting appropriation of scientific data by those who

should know better. Similar objections have been raised from the philosophical perspective but in this case directed against the way in which philosophy and even theology itself is used by theologians when engaging in such manoeuvres (e.g. Ruse, 2007:579-80). An implicit recognition of this enduring *dis*-ease at the heart of academic science/religion engagement, and also possibly of the accuracy of Drees' stark assessment, is attested to by ongoing attempts to examine and restate the basic nature of the debates (Drees, 2010), reframe the meeting ground (Hefner *et al.*, 2010:419-522), and develop new methodological strategies (Gregersen and van Huyssteen, 1998a). It is also apparent in the stringent criticisms which have attended the emergence of new sub-disciplinary fields such as neurotheology (Coles, 2008:1956; Geertz, 2009:319-24).

But while much has been written and continues to be written on the *nature* of the relationship between science and religion, attention to and discussion of the actual *purposes* of dialogue is far less overt and explicitly laid out in either compendia of the field or individual texts. Such attention as there is tends to be fleeting and dealt with under discussion of models – where phrases such as 'unified accounts of human knowledge' are employed without their content being analysed or explicated (e.g. Gregersen and Van Huyssteen, 1998b:2). In effect discussion on *how* it is to be done swallows up that on *why* it is to be done. Thus for example the monumental *Oxford Handbook of Religion and Science* (Clayton and Simpson, 2008) has, amongst its fifty-five chapters, nothing dedicated to specifically examining the purposes and goals of interaction. Similarly, in his new introduction to the field, McGrath offers a fairly typical conflation of purpose and mechanics and locates any value in understanding *how* the two can relate to each other (McGrath, 2010:2).

A notable exception in this respect is Willem Drees who, though himself heavily involved in the science/religion field, has been very critical of its degree of progress and its intellectual health. As part of his analysis of why this stagnation might be so, Drees has explored the variety of purposes which engagement between religion and science appears to serve from insider/outsider perspectives. He discerns three main roles for this, two located at the community and one at the personal level: firstly there is the development of apologetics, which he construes primarily as apologetics for science/technology aimed at religious commu-

nities particularly in countries where religious sensibilities have wide-ranging impacts on social, educational, and political agendas. However he sees engagement also serving as a vehicle for formulating apologetics for religion in more secular societies, as well as for the place of theology within the secular, research-orientated university (Drees, 2010:12-23). There is certainly evidence to support this contention both as an historical (Harrison, 2008:255-71) and a current reality: for example much of the science/religion output aimed at general consumption, particularly that dealing with evolution, takes the form of arguments that it is not necessary to chose between scientific and religious understandings of the world (e.g. Miller, 1999; Ruse, 2001). The second identified purpose is that of providing legitimation or authority for different belief positions *within* religious traditions – in effect as a weapon in intrareligious battles (Drees, 2010:24-9). Once again there is corroboration for the claim, this time in the form of the historical analyses already alluded to. These, along with others (e.g. Numbers, 2009) which explore and explode myths surrounding such *causes célèbres* as the Galileo affair or Huxley's battle with Wilberforce, lend support to the idea that science/religion engagement is, at least sometimes, used primarily as battle for authority between revisionists and traditionalists *within* each of the contributing traditions. Finally, Drees sees an important role located at the personal level. Here it functions to provide resources enabling individuals to manage the dissonance between their own self-images and the (reductive) images of the human (and indeed the wider world and cosmos) furnished by science (Drees, 2010:29-37) and the questions this then raises about matters such as agency, free-will, resurrection, and the soul. In support of this a good case can be made that, despite his denial of a primary apologetic intent (Polkinghorne, 1998:85), the main beneficiaries of Polkinghorne's extensive corpus are those involved or interested in scientific discourse who see McMullin's necessity of striving 'to make [their] theology and [their] cosmology consonant in the contribution they make to this world view' (McMullin, 1981:52); or who wish to attempt a coherent defence of their faith when charged with committing 'intellectual suicide' by attempting to hold onto religious belief (Bennett, 2012:193). This also seems very much the case with other well-known works in the field, particularly perhaps those dealing with topics such as emergence, consciousness, and soul (e.g. Brown *et al.*, 1998; Clayton, 2006; Murphy and Stoeger, 2007).

But whilst there appear to be grounds for claiming that apologetics, power struggles, and promoting personal comfort are – even if unacknowledged – all reasons why the two perspectives might be brought into dialogue, it also seems clear that these do not exhaust the *'why?'* aspect of engagement. Certainly the vision statements of both *Zygon*, and *Theology and Science,* indicate something more than simply apologetic intent. Either implicitly or explicitly, a larger claim appears attached to many efforts to construct dialogue *viz.* not only that it enriches and expands the understanding of *both* disciplines equally (e.g. Murray, 2011:123), but also that it potentially produces a fuller picture of 'reality' than either discipline generates alone. Claims to bi-directionality, equality of contribution (e.g. Newberg, 2010:54), and that theology can provide science with answers to the meta-questions which it raises but cannot itself answer (e.g. Polkinghorne, 1991:75) are fairly commonplace in the literature. However the reality of the situation is somewhat different: van Huyssteen's summary of his Gifford project (which was built on a strong, re-envisioned account of mutual contribution) provides a more realistic picture of the actual state of affairs with the author seeing its 'most important interdisciplinary result' as the powerful revisioning of the theological notion of the *imago Dei* in the light of the scientific contribution; at the same time, he remains virtually silent on what the theological input has contributed to the thinking of scientists (he adds the revealing qualifier 'sympathetic') on human uniqueness (van Huyssteen, 2006:322-3). Further supporting evidence can be adduced from the introduction to one of the most recent 'companion' volumes to the field (Harrison, 2010:3) which, in its delineation of the key issue clusters of science/religion, has several relating to theology in the light of scientific advance, but none in which this polarity is reversed.

Seemingly then, the issue of dialogical purpose is not currently particularly prominent in the consciousness of science/religion engagement. However, for the emergence of a sub-disciplinary hybrid such as neurotheology, the question is a vitally important one since it not only defines the identity but also profoundly influences the shape, structure, and situatedness of the embryo discipline. In the case of neurotheology, these questions as to purpose and identity carry additional freight from the perspective of the role of theology, particularly in light of the fine dividing line from the scientific study of religion: depending on how such questions are answered, it could potentially vary from merely providing subject matter

for study through to actively contributing specifically theological content towards expanding understanding. Arguably though they have not been entirely successfully addressed as yet: on the one hand the declaration and discussion have been either vague or even absent – for example Ashbrook, who introduced the term into science/religion discourse[4], never explicitly defines neurotheology or its remit. On the other hand, as I argue further section 1.3.2 (p31)**,** Newberg offers what can only be described as an immoderate specification of purpose, with the result that the potential territory of neurotheology becomes so vast as to be almost unmanageable or, in places, remain coherent. It will be the strong contention of this thesis that a combination of clear purpose and robust methodology can generate a model of neurotheology in which both neuroscience *and* theology are enabled to make a direct contribution to expanding knowledge. Fashioning such a venture however, also requires attention to the epistemological and ontological knots which underlie science/religion engagement, since these too have a bearing on the development and potential shape of neurotheology.

1.2.2 An unbridgeable epistemic divide?

Both science and religion claim to give description to the same world and the human experience thereof, and thus the primary locus for tension between them is usually perceived as being epistemological. Each discourse has its own sources, resources, and distinct and rich vocabulary embedded in a dedicated semantic field. As such they are understood as having radically different preoccupations, questions, and purposes – the oft-repeated (albeit inaccurate) maxim being that 'religion asks *'why?'*, whereas science asks *'how?'*

It is in response to this apparently unbridgeable divide that the various typologies of engagement which have been a hallmark of the science/religion field have been formulated. These include Barbour's original, classic, four-fold taxonomy of conflict, independence, dialogue and integration (Barbour, 1990:3-30) and its assorted variations and revisions (e.g. Haught, 1995:9-26; Peacocke, 1993:19-21; Peters, 1997:650-4; Polkinghorne, 2004:10-22; Stenmark, 2004), as well as the distinctively different appropriation of Niebuhr's five-fold 'culture' (Murphy, 1985:16-23) and different literary genres (Richardson, 1994). Of these approaches, Barbour's model has been the most used and his delineation and defence of the

[4] It actually originated in Huxley's 1962 novel *Island.*

possibility of dialogue and integration, and its underpinning stance of critical realism have become an enduring legacy (Gregersen and Van Huyssteen, 1998b:3).

The mainstay of the modern dialogue has thus been to claim methodological parity through shared use of a critical realist approach to investigation: both disciplines are held to move from interpreted experience, via metaphors, models, and theories, towards increasing verisimilitude with reality (Polkinghorne, 1996:3). This kinship has then been taken as a substantive way to bridge the gap between the two disciplines (e.g. Polkinghorne, 2007) and thus to facilitate engagement and dialogue, and work towards a 'viable unifying account of human knowledge' (Gregersen and Van Huyssteen, 1998b:2). However citing a critical realist stance as a basis for claiming epistemological parity is not without its difficulties for theology: The very nature of theological reflection and its attendant commitments mean that, with respect to both the criticality of its thinking and the extent to which it can lay claim to producing realist accounts, theology is vulnerable to charges of having less entitlement to the label than it claims (Bennett, 2012:179-88). Even when epistemological parity *is* accepted, there is still, *de facto*, a marked asymmetry to the dialogical and constraining relationship between the two disciplines which is openly acknowledged (Polkinghorne, 2006:171). Once again this returns us to the question of purpose and the related question of whether dialogue can be a genuine opportunity for *mutual* enhancement or enlightenment or does it (implicitly or explicitly) necessarily entail a degree of assimilation of theology to science? And if the latter, what are the limits to this? On this point, major differences exist between the committed proponents of consonance dialogue (Polkinghorne, 1996:8): Polkinghorne for example has always been much more resistant to assimilation than Peacocke, resolutely defending a portfolio of non-negotiable theological commitments (Polkinghorne, 2004:10).

In the case of neurotheological endeavour, the way in which this question has been answered – both implicitly and explicitly – illustrates the potential pitfalls of pursuing the assimilative route and the profound difficulties of attempting to give equal weight to both scientific and theological input without an adequate methodological framework. In a rapidly developing field such as neuroscience, the first of these runs the risk of building an inescapable and possibly rapid obsolescence into the output – as has happened with Ashbrook. In the case of the second, any

attempt to construct an exchange in which the *a priori* assumptions of neither discipline are privileged has to negotiate a variety of challenges. The absence of a robust strategy for managing this leads, as is sometimes the case with Newberg, to scenarios in which nothing useful, or sometimes even coherent, can actually be said.

Enfolded within this general question of purpose is the further subset of questions alluded to in the previous section, whose fulcrum is essentially the issue of the direction and symmetry of dialogical flow: who are the beneficiaries of any science/theology engagement? Does it genuinely contribute to a more widely accepted expansion of human understanding of the nature of reality, or simply generate more sophisticated forms of apologetics for those with concomitant religious and scientific commitments? In what senses can or do theologies contribute to either scientific understandings of the world or to scientific approaches to understanding the world? One need neither dispute that theology contributes to hermeneutics generally nor have the dialogical, epistemological, historical, or anthropological naiveties identified by Jackelén (2008:289-91) to legitimately raise such questions *outside of the dedicated sphere of science/theology interaction,* particularly in view of the critiques of the field from both without *and* within which were highlighted in the opening of this section

Closely allied to these questions are ones which also pertain to the 'encounter' element of the dialogical dynamic. These relate to the issue of *which* voices (particularly from the theological side) are admitted to dialogue. From an hermeneutical perspective we have rightly become suspicious of 'singular forms' and thus no longer speak simply of science and theology *en bloc,* but rather of science*s*, and theolog*ies* (Jackelén, 2003:212). Moreover, as I will discuss further in Chapter 2, simplistic understandings and assumptions about the nature of scientific progress and the uniformity of scientific knowledge are no longer tenable in the light of even the less extreme of postmodern interlocutions. Nevertheless, there is still an important sense in which scientific accounts of the world are much less fragmented and mutually contradictory than theological ones. If the primary purpose of dialogue is to refine religious understandings of the world then there is essentially no inherent difficulty in engaging scientific perspectives with different and possibly mutually exclusive religious ones – for example on creation or godly ac-

tion. However if the aim is to offer a theological contribution, either to illuminating scientific understanding of certain matters (whether of perspective or process) *per se,* or to the development of an expanded understanding of the world and its workings, then this raises issues about proposed contributions which much be addressed: which of possibly conflicting theological positions can 'science' be reasonably expected to engage with, and how are these choices to be legitimated? What, if any, place can there be for 'non-negotiable commitments' (both theological *and* scientific) in such a dialogue? Does separating theological insights about humanness from the faith propositions of the systems which give rise to them, reduce them to Westhelle's 'anaemic myth' and the theology to debased coinage (Westhelle, 2000:171-2)?

The ramifications of such questions are particularly acute for any effort to develop a coherent account of what form neurotheology might take. However, as I will subsequently argue and then demonstrate through the course of this thesis, conceiving this in terms of a transdisciplinary venture and allying that construct to a suitable methodology, provides one way of negotiating these various difficulties pertaining to the 'encounter' and 'exchange' aspects of dialogue. It also, as I will discuss in Chapter 2, opens out the possibility of a new way of integrating theological and scientific insights to generate a discourse which is both coherently and distinctively neurotheological. In an era marked by increasing disciplinary subspecialisation and where information production is outstripping and swamping use at both individual and institutional level (Frodeman and Mitcham, 2007:507), such essays form a key part of a much larger and vital project to re-evaluate understandings of knowledge construction and validation. However any attempt to integrate the very different knowledge of theology and neuroscience also requires attention to the ontological knot underlying the science/religion dynamic, since this too has important implications for various aspects of the neurotheological enterprise – particularly as regards the potential loci for fruitful exchange.

1.2.3 An irreconcilable ontological disjunction?

The disjunction here is essentially that between a discourse 'in the key of knowledge' and one 'in the key of mystery'. For the sciences the world is, in principle, completely knowable and understandable given time and appropriate application. Proceeding via well-honed empirical methods with an emphasis on testability, repeatability, and shared third person description and consensus, they have pro-

gressively expanded the boundaries of knowledge about the material world, providing an increasingly integrated and successful applied understanding of reality (Drees, 2006:109). Moreover they are seen by many as being not only unrestricted in their scope but also sufficient for a total understanding of the world – with all *'why?'* questions being essentially reducible to *'how?'* ones (Atkins, 2006:124, 127). In contrast, religions have always been far more cautious about what can be known and said of reality – both as to the completeness of the account that can be rendered of any phenomenon, and to the ultimate limits of human knowledge. In both respects, Christian thought has historically comprehended both cataphatic and apophatic elements in its explorations of both *Theos* and *anthrōpos*: in a contradictory simultaneity, God is both known and not known; can be spoken of and is for ever beyond speech. Similarly there are aspects of humanness, particular in relation to the spiritual dimensions of experience and life which remain ineffable mysteries.

However the difference extends beyond the issue of *what* can be known and expressed about God, humanness, and the world, to also encompass an aspect of *how* things are to be known (here taken in terms of ontological encounter rather than epistemological strategy). In understanding certain aspects of the world and human experience to be essentially mysterious rather than empirically understandable, religion approaches them in a different way. This is particularly well captured in the Marcellian concept of the mystery of Presence. Marcel describes two distinct levels of engagement with an 'Other': in the first of these, the reality encountered is subject to a process of abstraction and categorisation, being objectified and problematised in an attempt to discover its true nature (Marcel, 1949:116-117) – in effect the approach taken in science. However, those very manoeuvres preclude the possibility of a real encounter and thus of gaining true ontological knowledge of it, leading to what might be termed an 'hypostasis of absence' (Pamplume and Brombert, 1953:92). To fully know the other necessitates a further level of engagement in which such manoeuvres are set aside and the other is instead *encountered* as Presence. The apparent similarity notwithstanding, this is not simply a variation of the apophatic theme above: the issue here is whether, in the case of certain types of encounter with reality, the approach of interrogating and interpreting experiential data might actually cause that knowledge which we seek to understand and articulate to slip through our fingers – a sense cap-

tured in a line from Marcel's play *L'Iconoclaste* that *"Knowledge exiles to infinity whatever it claims to clasp"* (Marcel and Hanley, 2004:99).

The contrast with the purpose of scientific endeavour could not be plainer. Science may allow us to efficiently and effectively 'unweave the rainbow', but precise explanation, while making the world clearer can, as Keats intuited, also simultaneously diminish it – relegating the 'awful rainbow' to 'the dull catalogue of common things' (*Lamia II, 233*). Steiner's observation about playwrights and novelists that: '[He] who tells all communicates knowingness, not knowledge. He ruins in his creation the mystery of independent vitality' (Steiner, 2001:36) seems to encapsulate not only the dilemma, but also its deep paradox: contrary to what might seem to be the case, attempts to precisely specify the world may not fully deliver, and indeed may even *destroy*, a certain aspect of knowledge which humans instinctively recognise and value.

With respect to the development of neurotheology, this is an issue which has particular ramifications for any proposed remit for the venture. Moreover, given the direction in which this is now increasingly tending with the development of dynamic brain scanning, it is a somewhat acute one: recent neurotheological work has predominantly taken the form of exploring religious experiences and practices from a neurobiological perspective (e.g. d'Aquili and Newberg, 1999; Newberg and Lee, 2005:469-89), in particular an attempt to determine their specific neural correlates. However in light of the critique above, the perennial question of what theology contributes to the project is not only heightened, but must also be joined by ones as to whether and how a greater appreciation of precise brain activity contributes to understanding such experiences or activities from a religious (or even simply an affective *human*) perspective: does knowledge of the neural correlates of an experience (to the coarse extent that we can currently investigate these) tell us decisively what the experience *is* or what it *means?* Furthermore some scholars are keen to extend this type of exploration into other areas such as the roots of religious thought. Indeed Newberg sees gaining a more precise understanding on what is going on in the brain during the formulation of theological thoughts and ideas as a key area for neurotheological exploration (Newberg, 2010:87-114). But whilst it might be interesting in some respects to speculate on, for example, what particular cognitive processes were predominating when Aqui-

nas and Luther were formulating arguments on freewill and ethics (Newberg, 2010:3), it would be reductive in the worst sense to think that understanding this will provide the ultimate key to the meaning and significance of these themes in their writing or indeed to understanding what these ideas signify more broadly for religious thinking.

Once again then the question of *'why?'* is critical: what is the presumed *purpose* of neurotheological engagement? As indicated by my second research hypothesis[5] and as I will argue further in section 4 below, construing neurotheology chiefly in terms of investigating the neural correlates of different aspects of religious life or spiritual experience emasculates its potential. Theological reflection within many different religious traditions has generated profound insights on the nature of the human condition which, with the employment of a suitably critical approach, can be combined with those currently being generated in different branches of experimental neuroscience to produce a richer understanding of humanness.

These then are the basic and ongoing tensions which attend any attempts at engagement between science and religion, and which play out in different ways in each of its three phases of encounter, engagement, and expression. I have suggested that both the dialogical *'why?*', and certain related outworkings of the epistemological and ontological tensions present problems to any attempt to construct a neurotheological perspective, and to decisions on where it should be located, how it should be conducted and what type of discourse it can produce. It is to a further exploration of these points that the chapter now turns.

1.3 Neurotheology: exploring the current contours

The recent explosion of the neurosciences has seen the 'neuro' prefix appended to philosophy, phenomenology, aesthetics, economics, and ethics amongst others. However whether these constitute disciplinary subspecialisations, interdisciplinary endeavours, or new hybrid disciplines is neither a clear nor a constant picture. A similar uncertainty appears to attend the precise identity of neurotheology. Although obviously signifying a conjunction of some kind between cognitive and

[5] A dialogue between theology and neuroscience can both optimise understanding of the nature of [the] connection between relationality and health, and facilitate the exploration of possible underlying mechanisms.

theological perspectives, how this is to be achieved and for what purpose is not self-evident. Neither is it always clearly spelled-out by those employing the term in their work. Indeed a striking feature of a substantial number of the papers which have carried 'neurotheology' in the title or as a listed keyword, including Ashbrook's original paper (Ashbrook, 1984b:331-50), is that it is never defined and often does not even appear in the actual text itself. This sense of vagueness is also reflected in both the wording of the formal definition given in *The Encyclopedia of Religion* and the number and spread of the potential contributors to the enterprise it which it lists:

> ..an emerging field of study that seeks to integrate *in some manner* cognitive neuroscience with religion and theology […] Neurotheology is multidisciplinary in nature and includes the fields of theology, religious studies, religious experience, philosophy, cognitive science, neuroscience, psychology, and anthropology (Newberg, 2005:6492, emphasis mine).

However as I suggested earlier, establishing a *raison d'être*, with its associated sense of identity and purpose, is an important element in both the emergence of a stable sub-discipline and the development of fruitful interaction. Nevertheless, and the lack of a generally agreed specification notwithstanding, it is possible to identify two distinct strands in neurotheology – an earlier one associated with the work of Ashbrook and the current one which is strongly associated with Newberg. Whilst there are some obvious similarities and overlaps between them, they are also distinctively different and each illustrates some of the specific issues attending any attempt to interface theology with neuroscience, and the difficulties which ensue if these are not adequately addressed.

1.3.1 Ashbrook: neurotheology as a unifying endeavour

For Ashbrook, the early pioneer of the discipline, the neurotheological project was conceived as being essentially one of integration. His approach reflects his own eclectic background (Ashbrook, 1996a:402-11), his work as a therapist, and his self-professed identity as being primarily a negotiator (Greenfield, 1996:47). This range of very different inputs influences and underpins his attempts to advance a case for giving the human brain privileged status as an analogical expression of God (Ashbrook, 1989:65-81), and to fashion a holistic understanding of the spiritual, psychological, and neurological dimensions of personal and spiritual life (Albright, 2010:480). His lack of explicit definition of the term he introduced has already been noted, however his neurotheology essentially involved taking the neu-

roscientific research that was then available and interpreting it in a theological framework: 'I turned to brain research to discern within it its theological promise. I found that theology presents parallels to the brain's regularities and mind's emergent properties' (Ashbrook, 1984a:314).

But whilst his preferred locus for encounter at the coalface of experimental neuroscientific research is easy to identify, analysing his methodology for 'exchange' and interpreting the resulting neurotheological theses presents something more of a challenge: Ashbrook employs an eclectic mix of sources, often proceeds by imaginative leaps and draws inferences in a way, and of a kind, which he freely admits as 'unscientific' but justifies as necessitated by the task in hand (Ashbrook, 1984a:307-45). Moreover his language is sometimes rather opaque and it is thus not always easy to discern precisely what some of his theses actually entail. However the following brief overview of *The Human Mind and the Mind of God* (Ashbrook, 1984a) and *The Humanizing Brain* (Ashbrook and Albright, 1997) gives an indication of the processes which his approach to neurotheology involves and the outcomes which ensue. There are several elements to this which cause significant difficulties for his project and thus throw further light on the question of how best to conceive the neurotheological task and develop stable and coherent neurotheological approaches.

In the first part of *The Human Mind*, Ashbrook takes as his neuroscientific base the functional asymmetry or lateralisation of the brain (the understanding that the right (R) and left (L) hemispheres execute different functions), synthesising a four-fold typology which divides mind input into either naming (L) or immersed (R), and mind output into analytic (L) or imaginative (R) (see also Ashbrook, 1984b:331-50). Such dichotomies are characteristic of Ashbrook and, as I will argue later, somewhat problematic. From this he then makes the leap of claiming that this same asymmetry is reflected in Christian history and theology and moreover that in each case, when the two halves do not work properly together, the response generated is flawed and inadequate: if one half predominates then function is *deficient;* if both halves are in competition, or frank conflict, then function is *disturbed.*

In essence there is a two stage shift involved in his development: from brain to mind and then the somewhat larger leap from human mind to divine mind. To

accomplish the second he uses the duality drawn by Ricoeur between the 'phenomenology of manifestation' and the 'hermeneutics of proclamation' (Ashbrook, 1984a:13) and once again he ties this to brain lateralisation. Thus manifestation reflects the R brain-mind (Ashbrook refers to them as a single unit) and is related *to* 'mystical-priestly-metaphysical-aesthetic' ways of perceiving God i.e. where 'people see and sense what God discloses in non-conceptual ways'*;* in converse fashion, proclamation, as tied to L brain-mind, he links *to* 'prophetic-ethical-historical doctrinal' modes i.e. where 'people hear and heed what God discloses explicitly' (Ashbrook, 1984a:13). Ashbrook's thesis here is essentially that 'the brain is the neurobiological substratum of the human mind, and the working of the mind is a reliable image of the intentions of God' (Hefner, 1985:346), and that people, particularly in the West, thus experience and interpret the way God works in ways which parallel how the brain works. Hence theologians distinguish between God's creating or world–affirming activity, and God's redeeming or world-transforming activity (Ashbrook, 1984a:10), which Ashbrook then links to right brain-mind (Ashbrook, 1984a:82f) and left brain-mind (Ashbrook, 1984a:78f; 1984b:336) respectively.

In part 2, by way of an exploration of the architecture of Hagia Sophia and Chartres Cathedral, Ashbrook uses this idea as a basis for analysing the differences between the theologies of Eastern and Western strands of Christianity. Here he correlates the former with the functions of R brain-mind and the latter with those of the L. Onto this base, he then maps his first thesis regarding deficient and disturbed functioning of the R/L brain-mind balance to suggest that the Eastern tradition suffers from R dominance deficiency resulting in too much vision and not enough sight (Ashbrook, 1984a:151-78), whereas the problem for the Western strand is a pre-occupation with inquiry at the expense of context rooted in L dominance disturbance (Ashbrook, 1984a:231-58). The impasse which he discerns between Western and Eastern Christianity is, according to his analysis, simply a microcosm of that which will continue to afflict humanity *en masse*, until it discovers the unity of one brain, one mind, one divine mind.

In the final part, he expands his thesis that the workings of the brain-mind mirror the nature and intentions of God, to take in humanity more generally. Here he focuses on connections between what he calls 'surface structures' such as lan-

guage and social interaction and the underlying 'realm of deep structure [which] provides the material for what is sensed, seen and spoken' (Ashbrook, 1984a:291). Surface structures are 'transformations of the deep common structure of humanity's capacity to conceptualise' (Ashbrook, 1984a:289). Thus from the story of Pentecost he infers the presence of the 'Primal Word below every word' and the 'Primal Community below every group' – the first reflecting the deep structure of language, the second the deep structure of participation (Ashbrook, 1984a:289f). We can only access these deep structures through the surface structures, but in our awareness of them we discover 'an order that goes beyond our ability to create or understand fully' (Ashbrook, 1984a:291). Once again Ashbrook draws on his base neurobiological material to suggest that although the surface structures are unavoidably constituted by the dualities which mark how brain-mind functions, they can become increasingly integrated as we access the deeper realities – something he couches in terms of a leap from the total disarray of Babel to the unity in diversity (diversity in oneness) of Pentecost (Ashbrook, 1984a:284f). In essence then, he constructs a whole system of analysis and interpretation on the back of a particular feature of brain structure/function.

The Humanizing Brain is similarly predicated on the conviction that the structures and processes of the brain reflect the nature and work of God. Drawing once again on a very particular neuroscientific base, Ashbrook and co-author Albright set out to explore how the workings of the human brain correspond with human understandings of the divine, taking common perceptions that God is 'ever present', 'nurturing', 'meaningful', 'purposeful' etc. and linking these to different aspects of the brain's evolution and operation. They describe their approach as 'one of convergence and overlap amongst technical disciplines' in which they 'combine the languages of religion, whether it is understood in broad cultural terms or narrower theological categories, with neuroscience talk to make sense of religion' (Ashbrook and Albright, 1999:9). Broadly speaking, their thesis is that, as the apogee of evolutionary processes, the orderly structure of the brain reflects the universe from which it emerged and points to the nature of its ultimate reality – God (Ashbrook and Albright, 1997:20). Since it is on this evolved brain that religious experience depends, neuroscience in effect also studies, albeit indirectly and unintentionally, God and the human experience of God: 'So, in the era of the brain, religion finds its logos, its inner logic, in terms of the accumulating evidence of

neuroscience' (Ashbrook and Albright, 1997:xxvi). Ashbrook is however at pains to point out that taking the brain as an analogical metaphor for God is not to be seen as a reductive manoeuvre (Ashbrook, 1996c:389).

The first part of the book lays out a neurobiology of faith in which the central element is the contention that human brains have evolved to be both human*ised* i.e. to seek out and respond to faces, and to collate and organise experiences and memories, and human*ising,* i.e. 'the mind-producing brain compels us to deal with our universe as a human-like reality' (Ashbrook and Albright, 1999:18). Thus they offer an account of reality which is constructionist but also involves critical realism: the brain creates its own orderly environment but its perceptions, including religious ones, do 'tend to have referents in reality' (Ashbrook and Albright, 1999:9).

In the second part, Ashbrook and Albright attempt to establish the connection between the brain and religion using MacLean's model of the triune brain (Maclean, 1990). Their thesis here is that the three different anatomical and functional sections proposed by MacLean are also suggestive of various ways of 'understanding God's ways of being God' (Ashbrook and Albright, 1999:20). Thus the 'reptilian brain' which, in MacLean's scheme, attends to concrete matters of survival, is seen as reflecting an understanding of reality, and thus of God, in functions such as territoriality and hierarchical social relationships. Similarly the 'old mammalian brain' correlates with images of the loving and nurturing God, as found through personal attachments and emotional responsiveness which give meaning to life. Finally the 'neo-mammalian brain', through its organising and pattern-making abilities, suggests 'God's creative power in ordering a universe whose vastness exceeds our comprehension' (Ashbrook and Albright, 1999:20). As in Ashbrook's first book, the explorations draw on a wide variety of sources to support different aspects of the thesis. These include the object relations theory of Winnicott (1965) and the complexity work of Prigogine (1984) and Kauffman (1996) as well as more esoteric material relating to interpretative readings of Michelangelo's Creation scenes in the Sistine Chapel. Theological influences are similarly wide ranging and include Augustine, Tillich, and Kaufman (1993); but they are also indebted to Hefner's 'created co creator' reading of the *imago Dei* (Hefner, 1993) and most of all to a Whiteheadian process theology.

What Ashbrook's neurotheology involves then is an attempt to bring together various aspects of human religious experience and understanding and neuroscientific understandings of brain structure and function to produce an integrated understanding of mind, brain, self, world, and God. Thus in some senses, his approach is not out of harmony with the metric set out by Schrag and van Huyssteen (see Chapter 2). However several aspects of the way in which he goes about this task present problems for both the durability and the wider applicability of the neurotheological theses which result. Thus they indicate knots which must be unravelled if the neurotheological project is to make progress. Although these problems shade across its boundaries, I want to consider them using the metric of engagement laid out at the beginning of the chapter. The first issue is therefore one of location – though this is not with the chosen field of neuroscientific research *per se,* but with the way in which Ashbrook uses extremely particular models of brain function as the whole basis on which to then build his neurotheological theses. Thus for example in *The Human Mind,* although Ashbrook refers to a whole range of the (then) current neurobiological data, he judges hemispheric lateralisation to be *the* lesson to be taken from such research and thus focuses almost exclusively on this as the foundation for his initial thesis. This, as indicated, then becomes the basic heuristic through which he analyses other things such as ways of perceiving and understanding God (Ashbrook, 1984a:10-13, 78-82), or Christian history (ibid : 151-78, 231-58). A number of dangers attend this sort of manoeuvre. Firstly, it may generate models or analyses which are simply inadequate: whilst in a vast field such as neuroscientific research it is obviously necessary to delimit the data with which one can feasibly engage, concentrating solely on one aspect of a complex system like the brain, particularly as a basis for developing a unified account or exploring other complex psychological, sociological or historical phenomena, runs the risk of producing models which are too etiolated or analyses which are too simplistic – something which is arguably the case with some of Ashbrook's theses, particularly in *The Human Mind*.

Secondly, in such a rapidly advancing field as neuroscience, tying a thesis and thus the analytic development based on it to a particular model of brain function, runs the risk of building obsolescence into the whole system (possibly very quickly) when models become disputed, or are superseded and discarded, and with it the potential undermining or loss of any and wider understandings developed from it.

This is a particularly acute problem for the assorted theses presented in *The Humanising Brain* because of its heavy dependence on MacLean. Although, as Smith (2010:1) notes, tripartite neuro-psychologies have featured through two and half millennia of Western thought, and thus MacLean's triune model stands in a long line stretching back at least to Plato's *Timaeus,* it is based on work which was already outdated at the time of its publication and which has subsequently been 'unequivocally contradict[ed]' by an extensive body of work in comparative neurobiology (Butler and Hodos, 2005:114). Thus whilst the model has retained support in the popular press and with some psychological and educational therapists, it has never been widely accepted and has had no enduring impact on neurobiology (in marked contrast to MacLean's work on the limbic system). This absence of scientific currency calls into question the lasting significance of the neurotheological formulations predicated on the model. It also highlights the dangers in trying to focus theological analyses through this kind of neuroscientific lens, particularly against a background of exponential growth in raw experimental data and understanding: in Rolston's pithy phrase "The religion that is married to science today is a widow tomorrow' (1990:87).

The question thus raised is not simply that of which experimental neuroscientific data and models form the best loci for any attempted engagement with theology and of how to identify these but, once again, the more fundamental one of purpose. Closely related to this is the issue, already hinted at earlier and which becomes even more acute with Newberg's proposals, as to whether conceiving neurotheology chiefly in terms of investigating and articulating spiritual experience and understandings in terms of brain structure and function is the most fruitful, or indeed the only, way in which the two disciplines can be brought together. It is the contention of this thesis that there are other possibilities for engagement which not only avoid some of these potential pitfalls but which also allow the theological side of the equation to extend beyond merely supplying the material for analysis, or contributing to the devising of better scientific studies by providing more precise delineations of 'spirituality' or the different nuances of various religious practices.

This leads inevitably to considerations of the 'exchange' element of the project. Here there are a number of pertinent points connected with how material – both

neuroscientific and theological – is handled. Whilst one does not expect an in-depth discussion of complex neurobiological technicalities, the actual degree of detail about or discussion of, the experimental data and its possible limitations on which Ashbrook draws is often quite slight, and statements such as 'New technologies are catching the mind in the very act of processing and thinking' (Ashbrook and Albright, 1999:16) generate a slight feeling of discomfort. As I will touch on in Chapters 2 and 4, one of the things which has contributed to the lack of credibility of some science/theology discourse, has been an occasional theological over-eagerness to appropriate and build on scientific theories and data without sufficient understanding of either the meanings of the former or the limitations of the latter. Whilst Ashbrook and Albright do not necessarily fall into this trap, their project does raise the issue of how, and to what extent, the non-specialist can successfully make extrapolations from, and then build models and theses using complex experimental data. One of the aims in this study will be to offer a clear account, not only of the current experimental data in the chosen areas of scientific study, but also of their limitations from both an experimental and an extrapolative perspective (see further at p129 for example).

Regarding the use of theological material, the issues are somewhat different, though equally relevant and no less acute. As already mentioned, Ashbrook draws on a variety of theological inspirations in formulating his different theses and there are a number of points to be made in connection with this. Firstly, in *The Human Mind* certain theological concepts – for example those of *analogia entis* and *imago Dei* – seem to be foundational. However the assumption that these enable us to make larger, and ultimately, given the nature of that thesis, *theological* sense of neuroscientific data, is simply assumed, never examined. Secondly, an unquestioning normativity is sometimes assumed for some of the theological and hermeneutic elements used in thesis construction – for example certain Augustinian elements, the opposition of creation with redemption, or Ricoeur's manifestation/proclamation typology (Hefner, 1985:357-8). Similarly, whilst in *The Humanising Brain* Ashbrook and Albright site themselves very firmly within the mainstream Judeo-Christian tradition, their use of process theology as the basic theological vehicle underpinning the project, draws on an articulation of God which many within that tradition might struggle to accept as a valid.

Once again this raises wider questions which were touched on earlier relating to the multiplicity of voices and perspectives within theology: how does one select a suitable dialogical partner from amongst the different possible theological voices – especially if these stand in contradiction to each other? Is it possible to use motifs from the theological canon – such as the *imago Dei* – which themselves, either historically or currently, comprehend a variety of different interpretations? In this thesis, I will argue that using van Huyssteen's methodology, in its identification of specific intersecting trajectories and in its requirements of a critical stance towards material offered to dialogue, provides a way of addressing these dilemmas. Ultimately all these issues lead to the further question of how widely useful or applicable any neurotheology can be which is formulated and articulated using ideas (and imagery) which are themselves very specific to or tightly tied to underlying dogmatic frameworks of one kind or another; and, in turn, of whether there are ways of using theological material which do not fall prey to this kind of difficulty. This is a question which is of central interest in this thesis and to which I will return briefly in section 4 below before addressing much more fully in Chapter 2.

Finally, I want to note the role which making imaginative and intuitive leaps (of faith) plays in Ashbrook's methodology and the questions this raises about how one moves between very different disciplines. Neither Ashbrook nor, as we will see, Newberg, advance any clear methodology for negotiating the interdisciplinary divides and disjunctions outlined in sections 1.2.2 and 1.2.3 above. For Ashbrook it essentially comes down to juxtaposing these disciplines 'as if they belong together. They may not correspond except through an act of faith or an exercise in imagination' (Ashbrook, 1984a:18). Whilst acknowledging the important role which imaginative leaps play, relying solely on such is methodologically inadequate. Arguably it leaves anything which Ashbrook builds on the back of such acts of faith and imagination (essentially the greater part of his neurotheological output) in a somewhat vulnerable position. It also raises a number of issues to do with the transfer of concepts and terminology across disciplines, and here neuroscientist Leslie Brothers has been very critical of what she terms 'neuroist literature' which equates the conceptual architecture of psychology with the neural architecture of the brain. Particular problems which she identifies are the use of shared words which have very different meanings in neurobiological and non-neurobiological contexts, and the drawing of analogies between the structures of

psychological concepts and the physical structure of the brain in ways which suggest the former is realised in the latter (Brothers, 2002b:857-70). However as I will suggest below and develop in the following chapter, there are methodologies which permit both the identification of points of correspondence in a much more defensible way and provide a safeguard against improper translations between disciplines, whilst at the same time, also allowing room for more imaginative handling of material. These thus provide a fruitful way of 'juxtaposing the disciplines' whilst avoiding some of the difficulties noted above.

The main issues surrounding 'expression' have already been touched on previously, notably the question of *who* the intended audience is, and of the difficulties associated with formulations tightly tied to particular religious traditions or subsets of these. To these the issue of clarity of formulation can also be added. Ashbrook's work is difficult to follow in places, being marked by both a certain ambiguity and some rather opaque elaborations – something which Hefner suggests is due to his awareness of the difficulties surrounding the task he is attempting (Hefner, 1985:345). These points once again highlight the need for neurotheologies to be conducted from the basis of a clear sense of identity and purpose – something which is also an issue in Newberg's work.

In the fifteen years since the publication of *The Humanising Mind,* research in the neurosciences has grown exponentially and advances in dynamic scanning, amongst other things, have generated a wealth of new experimental data, including material pertaining to various aspects of religious practice and experience. It is against this background that Newberg has recently made the first attempt to more formally describe and define neurotheology and suggest possibilities for its future development, and it is this project which now becomes the focus of discussion.

1.3.2 Newberg: neurotheology as equal exchange

Whilst 'no one person can define a field' (Clayton, 2008:3), Newberg's name is very prominently associated with neurotheology: both its formal delineation and the subsequent description of the potential field given in the *Encyclopedia of Religion* is predominantly a reflection of his interests, perspectives, and empirical work, and builds on substantive (but not necessarily *substantiated*) claims arising from these. Similarly the section in the *Principia* dealing with neurotheology's his-

tory involves no discussion of the work of Ashbrook or any other recent scholars using the term. In effect then, the current shape of neurotheology and the designation of its task are very heavily influenced by Newberg's preferences.

However his work has been strongly criticised from the perspective of methodology (Geertz, 2009:319-24), data interpretation (Goldberg, 2009:325-30) and, in a particularly withering critique by Cambridge neurologist Alasdair Coles, for demonstrating a complete 'deafferentation from both important neuroscience and mainstream theology' (Coles, 2008:1956). Moreover Newberg's sometimes hyperbolic and grandiose claims for neurotheology – for example that it will potentially 'propel scholars, and hopefully all of humanity, towards a new enlightenment' (Newberg, 2010:267) – seriously damage its credibility. He also makes assertions which are misguided and impossible to sustain – for example that neurotheology not only functions as a *meta*theology which can describe the general principles and rules for constructing 'any concrete theological system', but also has the potential to form the basis of a *mega*theology generating content that all religions could adopt as basic 'without any serious violation of their essential doctrines' (Newberg, 2010:64, 65). These latter claims have been rightly criticised as neurologically reductionist and naively modernist (van Huyssteen, 2006:259) and, particularly in the light of religious history, as being 'astoundingly naïve' (Geertz, 2009:321).

With respect to Newberg's recent *Principia*, while its aim of comprehensively mapping out a substantive territory for neurotheology is laudable, the project founders at key points precisely because it fails to address fundamental issues as to where and how theology and neuroscience might intersect. In the case of *'where?'* the territory claimed on neurotheology's behalf is simply too vast to be either manageable or, at times, remain coherent as a distinctive enterprise. The difficulties resulting from this lack of delimitation are then amplified by those attending the *'how?'* question. Here the problem is principally that despite bold claims about the nature of the proposed dialogue between the disciplines, Newberg offers no clear strategies for managing the actual mechanics and tensions associated with these. Not only is this rooted in a failure to answer the more fundamental *'why?'* question, but the combined result of these two issues is a failure to establish clearly what form any resulting neurotheological discourse is to take,

and what weight its insights might legitimately claim in any given interaction. This leads to a scenario in which, despite Newberg's claims that neurotheology represents 'a fundamentally different form of scholarship in the science-religion arena' (Newberg, 2010:54), it is often difficult to see how it differs from the scientific study of religion, or how it can generate either the rich multidisciplinary dialogue or the distinctive new insights which Newberg promises (Newberg, 2010:21).

A comprehensive critique of *Principles of Neurotheology* is beyond the scope of this chapter. Instead I will concentrate on some of the key features and issues with particular reference to the points made above. From this I want to draw out three things which Newberg's vision signally fails to deliver but which, in light of the issues considered in this chapter, are essential for developing a fruitful dialogue between theology and neuroscience: the need to delimit the field of enquiry and determine clear objectives for any engagement, and the absolute necessity of a well-defined and robust methodology for managing this. As I indicate in 1.4 and then argue further in Chapter 2, the proposed methodology for this thesis not only meets the latter requirement, but can also play a pivotal role in managing the first two necessities.

Newberg offers 'a foundation for future neurotheological discourse and scholarship' (Newberg, 2010:1) structured around fifty-four principles, the first of which states that neurotheology 'should strive to provide and seek clear definitions for the topics of its enquiry' (Newberg, 2010:23). It is therefore somewhat ironic, but also symptomatic of underlying problems, that the term itself is both imprecisely defined and also qualified by the observation that it is misnomered (Newberg, 2010:45). Newberg's initial basic definition that 'neurotheology refers to the field of study linking the neurosciences with religion and theology' reflects not only the more widespread ambiguity as to the nature of that connection but is also immediately widened to include both 'the totality of religion and religious experiences' along with 'psychiatry, psychology, cognitive neuroscience, genetics, endocrinology as well as other macro- and micro- perspectives of the neurosciences' (Newberg, 2010:45). Later principles that neurotheology 'should be applied to a wide range of cognitive processes' (**PXXV**) and 'address any and all theological questions' (**PXLI**, Newberg, 2010:185, 221), along with the associated discussions of these points, confirm the feeling of an envisioned disciplinary reach that is virtu-

ally unbounded. A similar sense is also carried across into the designated 'goals' of neurotheology *viz.* improving our understanding of the human mind and brain; improving our understanding of religion and theology; improving the human condition, particularly in the context of health and well-being; and improving the human condition, particularly in the context of religion and spirituality. This expansive stance is traceable back to what Newberg sees as a fundamental topographical feature of the neurotheological landscape – that all human perceiving, experiencing, knowing and construction is shaped by the fundamental constraints of brain function (Newberg, 2010:84-85, 214). Essentially the point here seems to be that since all religious thought and function is determined, shaped, and expressed via brain processes, then any and every aspect of it can be considered as ground for neurotheological exploration. Paradoxically this emphasis becomes something which actually severely limits the scope of Newberg's proposed neurotheology – a point I will return to shortly.

Whatever the roots though, the result is a proposed arena of encounter that is vast. This absence of any useful delimitation seems to stem from (rather than precede) a basic lack of clarity as to the precise purpose of neurotheology. This leads to a situation where a neurotheological approach assumes something of an 'Everest' rationale – topics are addressed simply *because they are there* rather than being actively selected as a point of intersecting interest with potential for a useful expansion of understanding through a combined approach. In some instances (e.g. Newberg, 2010:231-43, 245-7), this lack of limitation seems to bring the proposed neurotheological discourse dangerously close to vacuity.

However Newberg's vision for the loci of neurotheological encounter is, paradoxically, also somewhat too *narrow*: much of the reach envisaged actually exists within a single conceptual framework controlled by the perspective indicated above and formalised in his 'crucial' neurotheological principle (**PXVII)** of brain constraint (Newberg, 2010:84)**.** The stance towards theological and religious ideas which ensues focuses primarily on understanding *the ideas themselves* in terms of their cognitive underpinnings, and locates their primary value as a contributor to neurotheology in being thus understood. At times this approach, particularly in view of the lack of dialogical directives, strays perilously close to the reductive assimilation which Newberg wishes to avoid (ibid:3, 19, 54). Whilst there may well

be potential value in improving our understanding of the underlying cognitive processes in assorted aspects of religious thinking, this represents only one way of interfacing cognitive neuroscience and theology, and ignore the existence of other fields of encounter which may be equally if not more productive. Thus rather than focussing exclusively on trying to deconstruct theological ideas or religious experiences from a cognitive perspective, a neurotheological approach should also comprehend taking the ideas *themselves,* as products of a particular and long-established mode of human reflection, and interfacing them with the evolving perspectives on human personhood emerging from the current explosion in the cognitive neurosciences. This is the approach I will adopt in constructing the neurotheology of health in this project.

The vast range of possibilities within Newberg's proposed arena of encounter also raises the question of where, and for what reasons, neurotheological endeavour could be most fruitfully concentrated in order to build up some kind of basic corpus for the discipline and develop its distinctive identity. Newberg gives a clear indication as to some of his most favoured options for suitable loci – either via the principles themselves (e.g. Newberg, 2010:195, 225), as direct statements (ibid:21) or by the amount of text he devotes to certain areas such as health (ibid:195-210), or spiritual practice and experience (ibid:147-86). However what is less clear is the framework within which such judgements are to be made, since he presents neither overview nor specific guidelines for this. Although there is no explicit appeal to a search for consonances or for areas of overlapping interest, the implicit heuristic seems to be something akin to Midgley's multiple maps metaphor (Midgley, 2006:112-4). In the light of earlier comments about the imbalances between excessive knowledge production and our ability to assimilate or utilise it, what seems to be urgently required is some mechanism for identifying those areas which offer the combination of potential usefulness and possible dialogical fruitfulness, at which to coordinate and concentrate engagement. As I will argue in Chapter 2, van Huyssteen's transversal approach with its intersecting line heuristic is one possible mechanism for generating such delimitation.

However, there are other significant issues with Newberg's articulation of neurotheology beyond those relating to the locus of engagement. These relate to how dialogical exchange is actually to be managed, and stem from the combina-

tion of a strong claim to disciplinary equality, non-privilege and reciprocity but a complete absence of an adequate methodology for enabling this. At an early stage of making his case for developing a *principia neurotheologica,* Newberg offers a vision of neurotheology centred on constructive and complementary exploration in which all those involved must remain open 'at least somewhat' (the qualifier is characteristic) to all the different perspectives involved, whether religious, cultural, theological, or scientific (Newberg, 2010:16-17). But while the attitude is commendable, Newberg ultimately provides no clear guidelines as to how the 'constructive and complementary' nature of the dialogue is to be instigated and maintained. This methodological lacuna leads to a vacuum at the heart of the project into which it is, at times, in danger of collapsing.

This is not to say that discussion of methodological matters is absent: indeed Newberg himself explicitly links the establishment and flourishing of the discipline to the development of sound methodology and declares his intent to 'determine the methodological issues that currently affect the field and explore how best to address such issues' (Newberg, 2010:113). However his efforts are, to a large degree, concerned with practical experimental issues of study design and data interpretation (ibid:113-46) and do not address the actual dialogical mechanics of any neurotheological projects. There is of course always a danger that a focus on and preoccupation with such methodological considerations may lead to them becoming an end in themselves, at the expense of the search for specific insights and questions. Such dislocation from the bigger picture may then result not in the establishing of 'common working ground' but at best 'common horizons' and at worst 'common clouds' (Welker, 2006:553). These cautions notwithstanding though, attention to the methodological aspects of constructing neurotheological exchange and dialogue are vital if it is to avoid lapsing into vacuity or incoherence.

With regard to dialogical exchange, **PVII** states that 'Neuroscientific and theological perspectives must be considered to be **comparable contributors** to neurotheological investigations' (Newberg, 2010:54, original emphasis). Newberg sees this principle as key to the neurotheological endeavour and one moreover which enables it to achieve a 'high level of sophistication' (ibid). This requires 'a modicum' (the tepid word choice is interesting) of acknowledgement of 'the value, importance, significance and accuracy of both religion and science' (Newberg, 2010:45),

but the *Principia* itself gives no indication of the grounds on which this assent is to be founded. Moreover the designated cornerstones for ensuring equality merely highlight the difficulties they signally fail to address. Here I want to focus on the second such cornerstone: the disqualification of any *a priori* assumptions which automatically privilege either discipline.

Newberg makes it clear that the assumptions of neither discipline can be privileged as normative in advance of any analysis (Newberg, 2010:55). However in the absence of any suggested methodology for doing so, it is not clear how an *a posteriori* decision about the direction of any causal arrow is actually to be made. It is thus difficult to see how any distinct neurotheological interpretation can be arrived at, offered or defended. The scenario offered as an illustration of the principle in action – a hypothetical study of brain activity in nuns experiencing the presence of God – is in fact an exquisitely apposite exemplar of the problem:

> If we find there are specific changes, what causal conclusions can actually be drawn? **The most that can be said** is: there are certain brain activity levels associated with the experience […] The results do not suggest either that the brain activity caused the experience...or whether the findings reflected the brain's response to the experience. [But] the brain scan only suggests that there is a link, and does not necessarily help to point the causal arrow one way or the other (Newberg, 2010:55, emphasis mine).

Newberg makes the somewhat obvious observation that non-religious and religious perspectives will point the causal arrow in diametrically opposite directions but gives no indication of how in these circumstances a neurotheological approach would determine causality other than the vague suggestion that it 'might be possible' to set up a study which allows a more specific determination of causality. Given the important place which studies of brain activity hold in his overall project, this lack of any methodology for guiding interpretation of data is all the more striking. Tendering 'the most than can be said' descriptions of results as neurotheological 'insight' does not make its discourse distinctive but instead renders it vacuous.

Newberg glosses over the obvious difficulty here by maintaining that such an approach demonstrates the 'substantial questioning and healthy scepticism' which neurotheology demands. Indeed he even formulates this into a further principle of scepticism which questions both science and theology and thus allows neu-

rotheology *to* 'explore the intersection between the two far more thoroughly' (**PVII** Newberg, 2010:56). Subsequent comments that scepticism must then be allowed to give way to new ideas and paradigms, and that neurotheology should be open to and evaluate all such possibilities, simply shift the problem of '*how?*' to another location. The claim that utilising such scepticism will help in either exploration or in determining which approaches and lines of questioning will be most fruitful (Newberg, 2010:56) is meaningless in the absence of a either a methodology or a specified larger framework against which to do this. The development of a neurotheological addition to Occam's razor in **PXVI** that 'we must not assume what constitutes necessity until we have adequately evaluated all of the possible pluralities' (Newberg, 2010:83) is similarly unhelpful when examined. Again the aim is to outlaw any prior philosophical commitments as being normative and thus constraining the answer. However once again this approach falters because there is no strategy for how the 'possible pluralities' are then to be 'adequately evaluated' and an *a posteriori* conclusion of what constitutes necessity arrived at: the neurotheological razor may cut in very different directions depending on the disciplinary hand which wields it, but no neutral mechanism for doing so is specified.

Once again the question of *'why?*' lies at the heart of these problems, but this time it is rooted in the confusion as to disciplinary identity which runs through Newberg's project. This confusion is due partly to the extreme expansiveness of remit previously noted, and partly to an unresolved tension between his wish to espouse (for both pragmatic and personal reasons) a non-reductive stance with respect to the religion/theology, and an essentially physicalist stance with respect to the limiting role of brain function. Newberg consistently denies reductive intent and proposes mutual illumination, but while it is evidently possible that there may be different aims in different scenarios, there is a general vagueness as to whether outcomes are envisioned as a harmonisation of accounts, a sharpening of theological/scientific understanding of a particular issue, or the generation of novel insight. Newberg's general claims for neurotheology as a discipline implicitly suggest that the latter is the preferred aim, but by what criterion a suitable outcome might be decided for any specific project is unclear. Nevertheless the answer to the question of *'why?'* is vital since it will affect not only the nature of the study itself but also the form of the resulting output, and to whom it might be

supposed to be of interest. This also brings into sharp focus the difficulties which arise when, either explicitly or implicitly, the fulcrum on which engagement between theology and science pivots is that of causality. One of my contentions in this thesis is that there are other axes around which interaction can be constructed, and that these are not only give far more scope for rich theological input but also have the potential for genuine bidirectional exchange and the generation of expanded accounts of aspects of humanness.

Ultimately, these unresolved issues of identity and purpose, combined with the lack of any clear strategy for interfacing the two disciplines not only undermine Newberg's twin claim that neurotheology merges 'these two [often incompatible] methodologies into one overarching discipline' (Newberg, 2010:63) and that a neurotheological approach enables a 'free exchange of ideas, data and information' (ibid:54), but ultimately lead to a dialogical vacuum at the heart of the project into which any claim to provide new and distinctive integrated insights is in danger of collapsing.

In summary then, both the form of neurotheology practiced by Ashbrook, and that envisioned by Newberg, encounter problems in each phase of the dynamic of engagement: for 'encounter' these have to do with the identification of either appropriate loci or suitable contributory material; with 'exchange' they relate to the coherence and defensibility of the methodologies employed or proposed; and with expression they concern not only the generation of stable or coherent outputs, but also the development of a distinctively neurotheological discourse. These difficulties, particularly in the case of Newberg, also seem to have roots in a lack of a clear identity for neurotheology and a related inadequate delineation of its primary purposes. Many of the identified issues are potentially remedial with the employment of a suitable methodology and they do not therefore fatally undermine the attempt to conjoin religion and neuroscience in the ways envisaged by Ashbrook and Newberg. However such approaches do not exhaust the possibilities of neurotheology and in this thesis I want to explore a distinctively different way of bringing together the two discourses and combining their insights. My interest here is not just in finding a way of negotiating the difficulties in interfacing either science/religion generally or neuroscience and theology specifically but also, as part of a larger project, in whether and how we can address the issues

raised by increasing disciplinary subspecialisations and the attendant generation of a large and rapidly growing volume of disconnected quanta of knowledge. The final section thus briefly outlines the direction I propose to take in this thesis for developing a neurotheological investigation of the links between relational connection and health. By clearly identifying both purpose and locus of engagement, and through adopting a robust methodological approach and generating a distinctive discourse, this seeks to address some of the issues highlighted as problems in Ashbrook and Newberg's projects. At the same time, it is also an attempt to respond to some of the questions raised in section 1.2 regarding the purpose of dialogue between science and religion, and to explore the possibility of bringing together scientific data and theological insights in a very different way to develop what Morin describes as 'complex knowledge' (Morin, 2008:2-6). Once again I will structure this brief outline according to the three-fold heuristic of encounter, exchange, and expression offered at the beginning of the chapter.

1.4 Neurotheology: expanding the roadmap

One of Newberg's foundational goals for neurotheology is 'to improve our understanding of the human condition particularly in the context of health and well being' (Newberg, 2010:18). In his case, the suggested arena for intensive neurotheological exploration is the connection between spirituality/religious involvement and health. This is an area which has generated a huge amount of interest in recent years alongside a wide range of books and papers claiming that religious involvement leads to a significant improvement in health outcomes (e.g. Chamberlain and Hall, 2000; Koenig and Cohen, 2002; Koenig *et al.*, 2001). However there are serious difficulties with some of these data-sets, many of which are drawn retrospectively from epidemiological studies examining other issues – something which has led to charges of data dredging. Other issues include poor controls for confounding variables, and vague and inconsistent definitions of spirituality and health (for a review see Sloan, 2005).

In the current project, rather than exploring a particular aspect of religious involvement or practice and health I want to take a somewhat different line: as I will discuss in Chapter 3, there is a wealth of evidence from both epidemiological and immunological studies to suggest a strong connection between the number and nature of social relationships and health outcomes. There is also a strong thematic

strand in both Old and New Testament narratives linking the experience of relationality with wellbeing. I will therefore be taking as the basic locus for neurotheological exploration the experience and expression of human relationality and its connection with health outcomes. These different evidential strands will be fully delineated and explored in Chapter 3 by way of grounding the proposed project. The aim here is not the development of an apologetic related to Christian views on health and healing, but to bring together various neurobiological and theological perspectives on human relationality and health as a way of expanding understanding of the connection between them. The wealth of data currently emerging from the neurosciences offer unprecedented opportunities for theology to engage with science around a very different set of questions, with the potential to move beyond apologetics into a much more truly bidirectional collaborative attempt to augment and enrich knowledge.

One of the major criticisms I have raised against both Newberg and Ashbrook is the lack of any clear methodology for engaging theology and neuroscience. I have also suggested that such methodologies are available, and in this project I will be appropriating one such *viz.* the transversal space dialogue developed and utilised by Wentzel van Huyssteen in his Gifford Lectures (van Huyssteen, 2006). From a basic philosophical stance of postfoundational rationality, this takes the notion of shared tools of rationality as the basis for the mutual acceptance of epistemic and intellectual parity and as such offers a different way of addressing the issue of disciplinary equality. It also opens the way to dealing with some of the other issues which have been raised, for example the delimitation of territory. Rather than looking for possible consonances of meaning, van Huyssteen's approach is centred on identifying intersecting lines of interest at which dialogue can be situated. The associated idea of opening up a transversal space (which belongs to none of the contributing disciplines) for dialogue, taken in conjunction with the acceptance of epistemic parity already indicated, raises the real possibility of achieving the bidirectional 'free exchange of ideas, data and information' which Newberg sees as the hallmark of neurotheology (Newberg, 2010:54). In this instance the intersecting point will be human relationality and the contributing disciplinary voices will be theology, cognitive neuroscience, and psychoneuroimmunology. This methodology, through its selection and accountability aspects, also provides a way of addressing the 'many voices' issue noted with regard to theological con-

tributions to dialogue, as well as the possibility of using such material in a way which preserves its *theological* identity without tying this to systematic particularities. In the next chapter I will provide a full exposition of these points as well as of the model itself and the further development which I propose below as the basis of the methodology to be employed in this study.

I earlier suggested that for neurotheology to claim legitimacy as a coherent enterprise, it must be able to produce and 'body forth' insights which are distinctively neurotheological in form and expression. To this end I further develop van Huyssteen's basic methodology in a way which takes it beyond the interdisciplinary confines within which he himself has employed it. In this, I expand the concept of transversal space engagement to support the production of what I term transversal arguments and models – that is, ones which also inhabit a space at intersections between the disciplines and which are therefore not constrained by any one of them but which belong to all. Over the course of the thesis, I will use the neurotheological exploration of relationality and health enabled by this approach to develop a model for a possible pathway connecting them via immune signalling mechanisms. The aim here is twofold: firstly to address the issue of uneven flow and constraint which have been identified as a feature of science/religion exchange generally and of Newberg's neurotheology specifically; and secondly to generate a perspective on the connection between relationality and health which can be coherently designated as neurotheological.

This alternative approach is thus not only in keeping with the concept of neurotheology as an engagement between diverse elements of cognitive neuroscience and theology, but also addresses some of the issues which have been noted in respect to the particular delineation of neurotheology explored in this chapter. It is also an essay into exploring different ways in which knowledge can be constructed and validated across disciplinary boundaries – an essential step in a world marked by ongoing disciplinary subspecialisation, explosive information growth and increasing complexity. In the following two chapters I will establish both the particularities of the methodology to be employed and the validity of the chosen ground for engagement between theological and neuroscientific insights and data. Subsequent chapters will then take the form of three separate transversal space connections between the contributing voices, each of which will provide

one strand of a transversal argument from which the neurotheological model will be derived and developed.

Knowledge in the Making

Postfoundational rationality and transversal approaches to dialogue

> How do we engage in enquiry? How do we think about the world, and more specifically, how do we approach research? Above all, how do we organise knowledge? How can we live and think in a pluralistic universe, with complexity, uncertainty and ambiguity?
>
> Montuori (2008:xxv)

> Explanation […] works by widening the context, not by atomising the structure.
>
> Midgley (2000:36)

> It is often at the boundaries between disciplines that new and exciting discoveries take place.
>
> van Huyssteen (2006:9)

2.1 Introduction and outline

The previous chapter raised questions as to the essential purposes of engaging scientific and religious discourses. I suggested that the explosive growth of the neurosciences opened up unprecedented opportunities for moving beyond either apologetic or reductive intent towards a much more truly bidirectional collaborative attempt to augment and enrich understanding of humanness. However to do this requires a robust methodological strategy for negotiating the assorted difficulties and tensions involved, something which is notably absent in both Ashbrook and Newberg's approaches to neurotheology. The purposes of the current chapter are thus firstly to explore, delineate, and develop such a methodology, and secondly to set out a clear statement as to the purpose and planned development of the proposed neurotheological exploration of relationality and health.

These will also be set within a larger noegenetic framework since it is against this that any claims to the production of both new and distinctively neurotheological understandings must be evaluated. The thirst for knowledge is, as Aristotle noted in the opening line of the *Metaphysics*, a defining characteristic of the genus

homo. Indeed we are as much, if not more, h. *quaerens* – 'the animal that asks and asks' – as h. *sapiens* (Steiner, 2001:16). This relentless pursuit of understanding has formed an integral part of human endeavour since grammar first allowed us to frame the thoughts of *'why?'* and *'how?'* But hand in hand with such questions have also gone ones about the nature of knowledge itself – its sources, construction, and validation. Human history has witnessed paradigmatic shifts with respect to these: in the West, pre-Enlightenment knowledge grounded in revelation and legitimated by the authority of sacred texts has given way to the narratives of modernity, founded on the appeal to rationality and the valorising of the scientific method. However these in their turn have now been challenged by the discourse of postmodernism with its suspicion of power relations, rejection of metanarratives, and emphases on the relative, context dependant and socially-constructed nature of knowledge.

Both of these shifts have implications for attempts to connect scientific and religious narratives and understandings. In the case of the first, its accompanying change in perception as to what constitutes 'reliable knowledge' about the world, brings into question the ability of, and extent to which religious thinking can contribute to this. The accompanying, narrowed definition of knowledge has heightened and reinforced the epistemological and ontological tensions outlined in Chapter 1. With the current shift, the challenge to the very heart of modernist assumptions about objective knowledge moves the focus of contention back to science, questioning its hegemonic claim to be the gatekeeper and arbiter of all 'real' knowledge of the world. Inevitably these postmodern critiques have been strongly and vehemently resisted, particularly from within the scientific establishment itself (Brown, 2001; Gross and Levitt, 1994; Koertge, 2000; Sokal, 2010). But nevertheless, and even when their extreme forms are discounted, they have still been acute and important interlocutors of modernist epistemologies, and as such have expanded our understanding of the nature, purpose, and acquisition of knowledge: one need not embrace the anarchism of Feyerabend (1975) to agree with Midgley's assessment (2006:50) that the idea that science represents a free-standing skill which is both omnicompetent for all human exploration and has a monopoly of rationality, is simply no longer tenable. It is this idea of rationality as a shared resource which lies at the heart of van Huyssteen's current approach to

interfacing science and theology and which underpins the dialogical model used in his 2004 Gifford Lectures (van Huyssteen, 2006) on which I will be drawing.

Long a proponent of the need to develop suitable methodologies for science/theology engagement (van Huyssteen, 1989; 1998a; 1998b; 1999), he is not unique in advancing a new approach to replace the current critical realist one. The internal tensions and sense of stasis noted in Chapter 1, along with the external pressures from the changing philosophical climate indicated above, have led to a various attempts to produce new dialogical models which address these issues (Gregersen and van Huyssteen, 1998a). However his transversal methodology is particularly promising from both a general and a specific perspective: firstly it negotiates a distinct path between the foundationalism challenged by postmodern thinking, and the extreme relativism it advances as a replacement. Secondly, it offers a combination of disciplinary rootedness, intellectual robustness, and cognitive fluidity which seems admirably suited to the particular issues and demands of neurotheological engagement identified in Chapter 1.

The following section of the chapter focuses on the concept of postfoundational rationality which structures this approach. In conversation with both van Huyssteen and several of his major dialogical partners, I explore three key elements of this reconfigured understanding: rationality as a practical skill; progress through responsible epistemic judgement and the role of experiential accountability. The associated ideas of transversality and transversal space dialogue will then be taken up and developed in section 3. Here I argue that these provide a robust mechanism for negotiating some of the previously identified difficulties attached to exchange between theology and neuroscience. However, as I suggested in Chapter 1, to claim that such an engagement can generate *distinctively neurotheological* insights or understandings is implicitly to offer something more than simply scientific explanations of religious ideas/behaviour, or experimental improvement through better definition and delineation of the religious material under investigation. Section 4 therefore addresses the issue of whether the proposed methodology can also generate a distinctively neurotheological 'bodying forth'. I argue that in both its philosophical underpinnings and its practicalities, the model supports not just interdisciplinary outcomes, but also the development of what I term transversal arguments and models. These offer the possibility of framing in-

sights in a way which is informed by both theology and neuroscience, but is not simply reducible to either of these in form or expression. This also facilitates a move beyond assimilative or apologetic function, centred on debates about causality, into territory where theological insights can be combined with those being generated via experimental neuroscience to expand and enrich our understanding of humanness. Thus it also addresses the issues of knowledge production and construction raised at the end of the previous chapter and underlined by Montuori's questions above.

Finally, I move from the general methodological to the specific contours of the proposed project. Section 5 sketches out the way in which van Huyssteen's model and the proposed extension will be used to bring together theological insights on aspects of relational connection with raw experimental data from cognitive neuroscience and psychoneuroimmunology, as a way of exploring the connection between relational experience and health outcomes.

2.2 Reconfiguring rationality

Van Huyssteen sees the prime locus of the postmodern challenge as being to rationality *itself* (van Huyssteen, 1999:3). Hence his response has been a move to recover its rich resources without falling prey to the problems associated with postmodernism. Thus whilst conceding elements of postmodern critiques against foundationalism and accepting the necessity of abandoning modernist notions of rationality rooted in it, he also rejects the relativist forms of non-foundationalism and contextualism urged by postmodernity. Instead, in conversation with a variety of pragmatist philosophers, he attempts to plot a course between 'modernist metanarrativist overstatements of universality and objectivity' on the one side and 'the extremes of postmodernist over-emphasis on contextuality and personal judgement' on the other (van Huyssteen, 2006:12). The result is an understanding of rationality not as an abstract cognitive notion but as a practical skill, operating in all domains of human life that

> enables us to gather and bind together the pattern of our interpreted experience through rhetoric, articulation and discernment (van Huyssteen, 2006:18).

This has important consequences for the dialogue between science and theology since it establishes a completely different basis for claiming epistemological and

cognitive parity between the disciplines (see p59ff). It allows van Huyssteen to acknowledge important differences in their reasoning *strategies* of the kind noted in Chapter 1, whilst also claiming significant epistemological overlaps between them because of their shared rational *resources* (van Huyssteen, 1999:187-8). Thus he argues that, whilst the skills might be more refined in science,

> effective problem solving and good judgement reach beyond the sciences and already form part of the common sense reasonableness by which we live our daily lives (van Huyssteen, 1999:12).

In itself this insight is not new: 'Darwin's bulldog' himself observed that science was 'nothing but *trained and organised common sense*' (Huxley, 1893/2011:45, original emphasis), a perspective with which others have concurred (Dewey, 1938:66; Einstein, 1954:290; Haack, 2007:95; Laudan, 1977:13; Sokal and Bricmont, 1998:54). However van Huyssteen goes beyond mere observation, developing a detailed case from bases in philosophical and evolutionary epistemology to support his contention.

2.2.1 Rationality as a practical 'transversal' skill

Fundamental to the notion of postfoundational rationality is the understanding that rationality is not an abstract concept which exists separately from contextual located humanness. Rather, it represents a complex embodied set of practical evaluative skills involving both judgement and accountability, and operating across the many different domains of human enquiry and knowledge. As such these have been developed through and conserved by evolutionary processes because of their survival value (Rescher, 1990:2-3; van Huyssteen, 2006:92); indeed they may ultimately define who we are as a species (van Huyssteen, 2006:11). It is through the performance of these everyday problem-solving skills that we identify and realise the key epistemic values of intelligibility and optimal understanding, and learn the crucial epistemic skills of discernment and responsible judgement (van Huyssteen, 2006:11). Van Huyssteen develops these ideas in close dialogue with Calvin Schrag, whose dissection of the postmodern challenge to modern foundationalism (Schrag, 1992), significantly contributes to his construction of a postfoundational rationality (van Huyssteen, 1999:139). Both see the problematisation of rationality itself, particularly as it figures in the discourse of modernity, as a key motif of postmodern discourse (Schrag, 1992:7; 1994:61). However rather than thus bidding farewell to reason (cf. Feyerabend, 1987:319), they em-

brace the postmodern critique of the classical and modern claims for universality, whilst at the same time using postmodernism *against itself* to develop a more productive alternative to the relativity which it proffers (Schrag, 1994:75; van Huyssteen, 2006:12). It is through this dynamic of negotiated passage that the basic idea of transversality which illuminates van Huyssteen's approach is engendered and developed.

Schrag couches the issue as a conflict between the vertical 'logos tradition' and a horizontal 'anti-logos of becoming' (Schrag, 1992:166). The former, grounding rationality in a substantive metaphysics, appeals to *a*historical essences and criteria; whereas the latter dismisses all such foundations and universals in favour of a 'cavalcade of signifiers' (Dallmayr, 1996:230), thereby leading to a complete relativisation of all forms of thought and culture (van Huyssteen, 1999:138-9). Schrag's reclamation project thus takes the form of a 'split the difference' approach between these two extremes (Schrag, 1992:166): the resulting 'transversal logos' offers an alternative to the hegemony of the vertical form but one which avoids simply plunging into the relativism of the anti-logos. His thesis here is that rationality operates not simply as a cerebral faculty, but also as a practical skill ranging over and across the array of actions and experiences which form our lives. As such it engages these and knits them together through three intercalated phases of 'communicative praxis': praxial critique, interactive articulation, and incursive disclosure (Schrag, 1992:63). Engaging these 'coefficient dynamics of transversal rationality' (Schrag, 1992:9) allows the formation of *trans*historical judgements and assessments which avoid both the discredited universalism of modernity and the disruptive heterogeneity of postmodernism (Schrag, 1994:75). This idea of the transversal operation of rationality also becomes a key feature of van Huyssteen's dialogical model (see 3.3.2)**.**

The first phase of the process – **praxial critique –** is essentially a pragmatic dialectics of participation and distanciation. The first of these provides a set of pre-theoretical, pre-cognitive, pragmatic understandings – an 'entwined 'knowing how and knowing what' of discourse and action – arising from 'the ongoing life of our intercommunal situatedness in the world'(Schrag, 1992:64). The second involves a stepping back in order to 'discern what it is that has been going on behind our backs' (see Ricoeur, 1981:131-44 for a fuller discussion of distanciation)

and furnishes the necessary and distinctively critical moment of rationality. Both elements are vital: participation without distanciation, in its blindness to resources for critical evaluation, 'congeals into traditionalism and conservatism'; while distanciation without participation, bereft of its 'background conditions', cannot offer discernment since this requires the prejudgements which flow from our situatedness in a particular linguistic community and world of social practice (Schrag, 1992:64-5). In essence then, the dialectic enables different options to be distinguished and assessed through the employment of practical judgements whose criteria are not antecedently defined (Schrag, 1992:61-4). Here Schrag views transversal rationality as an ability to identify areas of consensus and dissensus between the different constellations of thought and action which make up our situated experiences. Furthermore it also enables discernment of where these are already organically connected, where establishing connection might enable modification or transformation to occur, and where incommensurability precludes the possibility of any useful interaction (Schrag, 1994:66-70). Van Huyssteen identifies this ability to distinguish and then assess the viability and potential productivity of these different connections as the first step in the operation of transversal rationality in specific interdisciplinary conversations (van Huyssteen, 1999:137).

In the second key movement of communicative praxis, transversal rationality then finds its expression through **interactive articulation** of the choices made in praxial critique and of the best reasons supporting these (Schrag, 1994:70). Once again rationality moves from being understood as simply an abstract mental act and takes form instead through social practice: the understanding and articulation of how our beliefs and praxes 'hang together, bind and separate, come to be and pass away', and of the background features through which such practices are expressed and shaped (Schrag, 1994:71). Van Huyssteen further argues that this articulation is also *anticipative* in the sense that it identifies and marks out new possibilities for both discourse and praxis. This provides a new benchmark against which past and present forms of these can be re-evaluated. Critically, it also preserves praxial critique from being simply deconstructive, and thus takes it beyond the problems occasioned by extreme postmodernism (van Huyssteen, 1999:137-8). Once again the necessity of articulating the reasons for our rational choices is

underlined as an important element of both postfoundational rationality and the kind of interdisciplinary dialogue which it can engender and sustain.

Whereas articulation grapples with meaning, the final dynamic element of **discursive disclosure** is seen as being 'an act of reference' (Schrag, 1992:141). Here the incursion of life-world experience gives rationality a momentum which allows it to move outside the self-referential confines of narrative. Schrag's aim is to prevent the operations of transversal rationality becoming re-enmeshed in a hermeneutical subjectivism and self-enclosed textualism. Thus the incursive revelations of otherness into the dynamic of rationality serve as a reminder and reaffirmation of its connection with the concrete life-world giving rise to the experience and praxis on which it is operating. Disclosure therefore reminds us of the fact that we relate to our world(s) only through interpreted experience (van Huyssteen, 1999:138). For van Huyssteen this recognition and the associated dynamic of experiential accountability become critical features of his articulation of postfoundational rationality (see 2.2.3).

Essentially then, what Schrag's approach offers is an account of rationality which is configured neither in terms of a vertical appeal to ahistorical foundations, nor of a horizontal one to localised contextuality. Instead it involves a transversal appeal to specifically embedded and yet interconnected experience and custom. However this is not merely a play of consciousness over a range of experiences, but instead represents an active extension over, and linking together of, various forms of discourse, modes of thought and action. As such this transversal rationality 'resides in the domain of our social, communal and institutional practices' (van Huyssteen, 1999:136). For van Huyssteen this idea of a refigured rationality located in activity rather than abstract reason represents a retrieval of the rich resources of rationality which foundationalism threatens to stifle and postmodernity to dissipate. He sees such resources as offering fruitful possibilities to both scientific and theological thinking. Moreover in facilitating the transcendence of specific context whilst still in a very real sense remaining rooted in it, this transversal understanding of rationality offers the possibility of a completely different approach to interdisciplinary dialogue. However before this can be realised, van Huyssteen believes that the related and crucial question of what a postfoundationalist notion of *rational accountability* would look like must also be addressed

(van Huyssteen, 1999:140). In pursuit of this he undertakes a further development of two elements which become the cornerstones of his articulation of a postfoundational rationality: the exercise of responsible epistemic judgement, and the role of experiential accountability.

2.2.2 Rationality as responsible judgement

For van Huyssteen, developing a postfoundationalist perspective involves not just a refiguring of rationality but also a reconception of the epistemic quest itself. Since this can no longer be conceived within a framework of modernist notions of linear progress, absolute truth, and standardised knowledge, he redefines it instead in terms of making progress towards optimal understanding in any given situation. Consequently the epistemic skills of rational judgement and theory choice are seen as forming part of a fallibilist process of progressive problem solving (van Huyssteen, 1999:12). The importance of this pursuit of clarity and understanding is indicated by the high value language of 'epistemic responsibility' which van Huyssteen attaches to it, and his designation of it as 'possibly the most important epistemic goal that shapes the way we interact with others, ourselves and our worlds on a daily basis' (van Huyssteen, 2006:11).

This restatement of the epistemic quest brings two key questions in its wake which must also be addressed if the associated notion of responsibility is to be actualised: what constitutes 'optimal understanding', and by what mechanisms do we make progress towards it? The quest for intelligibility is a crucial factor for van Huyssteen here. However as his reconfiguring of rationality makes plain, this can no longer be inextricably tied to modernistic notions of foundationalism or to a hope for the establishment of indubitable certainties (van Huyssteen, 1999:114-5). Once again therefore he sets about establishing a postfoundational basis for the concept, envisaging it instead in terms of making assessments of, and judgements about, the relative problem solving potential of different models and theories. In this development a major conversational partner is philosopher of science Larry Laudan (1977; 1990; 1996), whose understanding of rationality has many points of overlap with van Huyssteen's own. Laudan's thinking on the nature of scientific progress, in particular his decoupling of the classical linkage between progress, rationality, and truth, together with his dissociation of progress and cumulativeness, are important to van Huyssteen's development of the connections

between postfoundational rationality and the exercise of responsible epistemic judgement

In defending science and its progress from what he sees as both the errors of positivism (1996:3-5) and the pernicious and intellectually bankrupt readings of post positivism (Laudan, 1990:x), Laudan offers a fresh reading of the threads which bind truth, rationality, and progress, and which link these attributes with scientific theories. Rather than seeing rationality as *leading* progress by its power to discern the increasing truthfulness of theories, he argues that rationality *consists* in making more progressive theory choices (Laudan, 1977:6). Moreover he dismisses the assertion that what science accesses can be claimed as either 'truth' or increasing verisimilitude to it (cf. Popper, 1969:228-34), arguing that we have no way of knowing whether or when this is in fact the case (Laudan, 1977:125), a sceptical stance which meshes comfortably with van Huyssteen's rejection of foundationalist frameworks. The most appropriate measures of the progressiveness of theories are thus related not to their nearness to truth but to their problem solving ability. In other words the primary aim is to produce *better* rather than *closer* estimates of truth (Rescher, 1992:53). Consequently the role of epistemically responsible judgement is no longer a matter of assessing different theories for their degree of correlation with truth, but instead for their relative effectiveness in problem solving, and then judging which is the more successful in this latter respect.

This inevitably raises questions as to the relationship between progress and problem solving capacity. Once again however, Laudan produces a decoupling which helps van Huyssteen's formulation. Here the received wisdom he challenges is the almost universal assumption that scientific progress is linked to cumulativeness. Laudan argues that this is not only incorrect but also belied by the history of science itself (Laudan, 1977:148-9). Thus it is not the case that progressive theories are those which simply expand the domain of solved problems. Instead progress is measured by the balance between the problems solved and those created, and the relative importance of these. Here Laudan also distinguishes empirical problems – questions created by the object of enquiry itself (Laudan, 1996:15) – and conceptual problems concerning the structures which have been derived to answer these first order empirical questions (Laudan, 1977:45-70). Since solutions to one type do not necessarily imply resolution of the other, indeed sometimes the

opposite, the key issue becomes whether those problems which have been revived by a theory outweigh those which it solves. This means that sometimes, progress can actually be secured by moving from an empirically well-supported theory to a less well-supported one, if the latter resolves significant conceptual difficulties confronting the former (Laudan, 1996:77, 87). Being able to asses this, and to specify circumstances in which a theory can be judged to be progressive even at the expense of a loss of some problem solving capacity, thus also becomes an important element in the exercise of epistemically responsible judgement. Similarly, since theories are never isolated entities but always situated within larger networks of research traditions, epistemic judgement also encompasses evaluation of the wider tradition in which any theory is itself located. Once again determinations of relative truth or falsity are irrelevant; instead what counts in the evaluation of progress is the problem solving balance these competing approaches provide (Laudan, 1977:119-20). It should however be noted here that Laudan does not provide any detailed development as to how any determination of which of two competing traditions has solved the most problems should proceed – something for which he has been criticised (Matheson, 2009).

What Laudan presents then is a fallibilist account of scientific progress in which growth in problem solving effectiveness, rather than presumed increasing verisimilitude, generates the dynamic of forward movement. Moreover, instead of being a necessary antecedent to progress, rationality becomes the mechanism by which such progress is made. It is thus freed from being understood as an abstract cognitive skill employed in the assessment of the relative truth of competing theories. Instead it is recast as a tool-set used to assess and evaluate their respective problem solving potential. This articulation of rationality as first and foremost a practical skill which science shares with other domains of enquiry (Laudan, 1977:13, 171) offers firm support to van Huyssteen's model of postfoundational rationality and its cross-disciplinary applicability. Similarly Laudan's account of scientific progress allows van Huyssteen to reclaim the epistemic quest from both the constraints of a foundationalism which is seen as no longer tenable, and the isolating disjunctions of relativism which threaten to consign it to being nothing more than a local, contextualised conceit. He is able instead to reformulate it in terms of the pursuit, via increasing clarity and intelligibility, of the optimal understanding of an issue (van Huyssteen, 2006:11). In this quest, post-foundational

rationality provides the necessary judgemental tools not just for problem-solving, but also for the evaluative discrimination necessary for making progressive choices.

It is also clear that rationality thus conceived is inseparable from both our self awareness and from the various communities, disciplinary and otherwise, in which we are embedded. This raises the inevitable question as to the role which our experiences play in the outworkings of rationality and brings us thus to the final element of the triad under consideration: the connection between rationality and experiential accountability, and the role which evidence plays in this.

2.2.3 Rationality and experiential accountability

The explorations of postfoundational rationality already undertaken have underlined the degree to which rationality is actually a deeply social practice 'always embedded in the narratives of our daily lives' (van Huyssteen, 1999:181). Moreover the indications that this is not just confined to our personal narratives but also spirals out to involve the larger networks – social, religious and disciplinary – in which we are embedded, highlights the extent of overlap which already exists between scientific and theological investigation and knowing.

The central dynamic in this re-envisioned account of rationality is one of articulation and critique: although part of the praxis involves the *giving* of interpretation-laden accounts, it also contains within itself the resources and tools for *evaluating* these. For van Huyssteen this conjunction is not only key, but also another example of successfully negotiating a way between the respective errors of modernity and postmodernity: in the case of the former its glossing over of narrative, and in the latter its blindness, through an over-enchantment with narrative, to the 'inescapable moment of evaluative criticism' (van Huyssteen, 1999:182). In contrast, the postfoundational rationality which van Huyssteen proposes allows a constructive appropriation of the return to locality and context demanded by postmodern understandings, and supports a process of critical judgement sitting over and above these. However a necessary element of the successful functioning of this dynamic is recognition of the connection between experience and the shaping of rationality itself – in effect a return to the content of Schrag's third movement of 'incursive disclosure' (p48).

Our specific embeddedness within a particular culture and time, our self awareness and self conceptions are thus not only intrinsic to rationality but are also indispensible starting points for any account of the values that shape human rationality. Moreover since the person-sensitive nature of rationality inevitably leads towards the attuning of our beliefs, decisions, and actions to the overall pattern of our experiences, we will always tend to find these rationally compelling (van Huyssteen, 1999:271). Hence just as scientific theories are never isolated entities, so theological and scientific reflection are also set within a wider community context, and the reflections of these communities give rise to the concepts, models, structures and language which also shape the experiential aspects of rationality.

Scientific data are thus inescapably theory laden. Consequently choices about experiments, observations, and interpretation are theoretically selected, and function within the network of presupposed theories that constitute a specific research strategy (Smolin, 2008, gives an illuminating account of this in the context of theoretical physics). To make such claims is not in any way to accede to the postmodern deconstruction of science, but it does give a way of legitimately understanding both how scientific belief has an inescapable personal dimension of commitment (cf. Polanyi, 1962:312; Ricoeur, 1967:351), and how all scientific knowledge can be seen as *beginning* in a local context. Similarly religious experience is always interpretation laden – shaped by the particular beliefs and commitments of the community in which it arises: beliefs and practices are interpretations of our experiences which in turn become objects of interpretation and assume explanatory roles (van Huyssteen, 1999:192). Hence in both science and theology, beliefs are both brought *to* and derived *from* experience, and interpreted experience thus becomes the matrix from which meaning and knowledge arise (van Huyssteen, 1999:191). A postfoundationalist model of rationality requires that we find a balance between the way our beliefs are anchored in interpreted experience and the broader networks of belief which are themselves the matrix in which these interpretations are shaped (van Huyssteen, 1999:14). This is equally true for both science and theology, but for the latter the intensity of Polanyi's inescapable 'coefficient of knowledge' is significantly heightened and thus the need to stand in critical relation to experience is similarly sharpened (Bennett, 2012:180-1,187-8).

Ultimately then what we know of the realities on which science and theology focus, irrespective of the extent to which these may be 'mind independent', represents information which is always and only attained through an interpretation of our experiences. For theology a vital consequence of this is that the content of belief can never be directly given in the experience itself; similarly religious cognition cannot be understood as directly experiential (van Huyssteen, 1999:188). Hence fideistic strategies which claim either the existence of a logic internal to theology or self-authenticating notions of divine revelation as a basis for disciplinary integrity are simply inadmissible to any neurotheological dialogue aimed at noegenesis. For both theology and science it is only once we recognise and acknowledge these roles which interpreted experience plays in shaping our access to reality, that we can then engage the epistemic skill of responsible judgement. Only then will we move to the rational accountability and thus to the fallibilism which a post foundationalist approach to the epistemic quest entails. Moreover such a move, in entailing a critical evaluation of personal beliefs offers the possibility of allowing us to transform these into 'genuine' knowledge (van Huyssteen, 1999:182-3), something I will return to in section 4.

This understanding that theology and science both relate to the world epistemically only through the medium of interpreted experience also has important dialogical implications. Firstly since both offer cognitive claims about the same world in the form of complementary interpretations of experience, the praxial critique element of postfoundational rationality itself demands that we seek some way of connecting these up. This serves as an imperative to find constructive ways of dialogue which can enable us to do this, of which I believe van Huyssteen's transversal approach is one. However this overlap also raises an important issue for theology as it approaches such dialogue, one which is exemplified by McMullin's assertion that:

> The Christian cannot separate his science from his theology as though they were incapable of interrelation […].He may, indeed must strive to make his theology and his cosmology consonant in the contribution they make to this world view (McMullin, 1981:52)

and which has fuelled the apologetic emphasis in science/religion dialogue discussed in Chapter 1. As already noted, both science and theology are embedded in assorted wider communities and traditions which also shape the actions of ra-

tionality and the type of experience which is found to be rationally compelling. Van Huyssteen argues strongly that for theology such beliefs cannot be declared off limits but must be critically examined in interdisciplinary conversation (van Huyssteen, 2006:114). What is obvious here is that the shared experiential accountability and rational resources revealed by a postfoundationalist approach mean that the rationality of theology cannot be seen as opposed to that of science. Thus any uncritical retreat to fideistic commitments seriously challenges the epistemic status of theological reflection as a credible partner in interdisciplinary dialogue (van Huyssteen, 1999:195). Whilst one may bring personal convictions deemed to be rationally compelling to cross-contextual discussions, at the same time postfoundational rationality also means that one is rationally compelled to open these convictions to critical evaluation as a part of such dialogue (van Huyssteen, 1999:202). This brings us up against the dialogical dilemmas caused by the issues of 'many voices' and 'non-negotiable commitments' touched on in the previous chapter, and raises the possibility that van Huyssteen's approach might provide a way of confronting these. It also brings to the fore the crucial matter of the nature and role of evidence, and it is to this that attention now turns.

Van Huyssteen's postfoundational account of the links between experience and evidence must therefore once again attempt to negotiate a path between extremes. This time the poles are the foundationalist notions which he rejects as no longer credible, and the potential for endlessly circling self-referentiality which postmodernism seems to entail. In order to do this, he draws on the work of Susan Haack whose pragmatist reconstruction of epistemology (Haack, 2009) pursues just such a 'split the difference' course. Like van Huyssteen, Haack's epistemology is an evolutionary one (Haack, 2009:281), and her basic stance is taken against the Popperian ideal of 'epistemology without a knowing subject' (Popper, 1979:106-152). Instead she argues that since claims and theories are always 'somebody's, or somebodies', any theory of warrant must begin with the personal and then move to the social, before it can get to grips with the impersonal sense in which we speak of a well-warranted theory or an ill-founded conjecture (Haack, 2007:60ff). Her argument is essentially that all knowledge is anchored in experience but is then justified by claims to coherence and she thus proposes a 'third way' forward which she terms 'foundherentism'. The goal of her restructured epistemology is to explicate an epistemic justification which both allows for the

relevance of experience to empirical justification, and for pervasive mutual support among beliefs (Haack, 2009:117). The first of these aims requires an articulation of the interplay of causal and evaluative aspects, and the latter an account of the difference between 'legitimate mutual support and objectionable circularity'(Haack, 2009:118). Since van Huyssteen has already provided the former, he looks to Haack principally with respect to how she tackles the latter.

In so doing, Haack works through a carefully and closely argued sequence involving the differentiation between the state and the content of belief, evidential and non-evidential components within the causal nexus of these, the strength of justification, and the role of the passage of time. From this she builds her case that the justification of our beliefs is never unidirectional but always involves relations of mutual support between them. However this relationship does not merely describe a perpetual circular trajectory but is genuinely interlocking (Haack, 2009:117-139). Here the argument is developed through the use of a helpful crossword puzzle analogy (Haack, 2009:126ff): in essence crossword clues become analogues of the subject's experiential evidence, and already completed entries analogues of their reasons. The reasonableness of any crossword entry depends on a number of things: how well it fits with both the clue and any other already completed intersecting entries; how reasonable those other entries are, independent of the entry in question; and how much of the overall crossword is completed. Similarly, how justified someone is in believing *that p* depends on how supportive their evidence is, how secure any reasons are independent of the belief itself, and how much of the relevant evidence their own particular moiety includes. Hence the good reasons for the beliefs we hold are always justified by a mixture of experience and other beliefs. In other words the *explicandum* is always couched in terms of 'A is more/less justified in believing *that p* depending on …' (Haack, 2009:58).

There are clear and obvious connections here with the account of postfoundational rationality which van Huyssteen is attempting to develop. Not only does the fallibilism of Haack's approach accord very closely, but also the way in which reason is employed to connect up, bind together and evaluate different elements of experience is strongly suggestive of the mechanisms of rationality which van Huyssteen has articulated. Moreover foundherentism offers support to key ele-

ments of his thesis, for example the argument that epistemically responsible judgement will always imply a choice between good, better and best reasons for retaining certain beliefs (van Huyssteen, 1999:224). Similarly Haack's notion of what counts as empirical experience, including as it does a wide spectrum of sensory introspective and memory experiences – all of which she argues are necessary for justified epistemic belief (Haack, 2009:16, 274) – is very much in keeping with his thesis. However it should be noted that here Haack is herself somewhat inconsistent in her application since, in keeping with her own rational precommitments, she admits to construing 'empirical' in such a way as to exclude *religious* experience (Haack, 2009:275). Van Huyssteen too has been critical of aspects of Haack's work, questioning whether in her application she is still in fact covertly privileging a species of scientific foundationalism (van Huyssteen, 1999:229). Nevertheless he sees her foundherentist approach to evidence and belief as essentially supporting his model of the operations of postfoundational rationality. Moreover it offers a useful account of the way these combine experiential accountability and responsible judgement to produce justified beliefs which are neither foundationalist nor depend on an illegitimate circularity of argument.

In summary then, van Huyssteen, through his engagement with Schrag, Laudan, and Haack, offers a rich, flexible, and well-supported revisioning of rationality which responds to the postmodern challenge without becoming dissolved and dissipated in it. This understanding sees rationality as a complex set of tools used for evaluation and expression which are shared across all domains of human investigative cognition. It recognises and acknowledges the vital role of experiential understanding, and allows us to remain connected in important ways with the formative traditions in which this is set. But at the same time, it also contains the absolute imperative to step outside of and stand in critical relation to them. Furthermore, it furnishes us with the skills and tools with which to do this, thus enabling us to us to reach out beyond our own immediate contexts in plausible forms of intersubjective, cross contextual and cross disciplinary conversation (van Huyssteen, 2006:10). Indeed in constructing his account through diverse and many levelled conversations with a range of other disciplinary voices, van Huyssteen himself does just this, and thus he also presents a vivid example of the skills of postfoundational rationality in action.

However his approach has not been without its critics, with both Osmer (2006:344-5) and Petersen (2008:468-9) questioning his dependence on evolutionary epistemology. In the case of the former because of a perceived tension between this and certain aspects of Christian eschatology, mission, and witness; in that of the latter because he deems such a dependence to be itself 'transparently foundational' – a charge which van Huyssteen has vigorously rejected (van Huyssteen, 2008:513-4). Despite using the model for aspects of his own interdisciplinary work (Osmer, 2005:308), Osmer has also expressed concerns that the language of problem solving which van Huyssteen deploys can be too easily assimilated back into the instrumental reasoning which characterises science and technology. Moreover he questions whether a problem-solving emphasis is appropriate for theology, given that religion deals in mysteries such as evil, suffering, and death which, in contrast to problems, do not necessarily admit of solutions (Osmer, 2006:345). However van Huyssteen's search for optimal understanding does not necessarily entail an assumption that a 'solution' is the appropriate endpoint. Moreover, whilst religion may not seek solutions to such issues, it nevertheless concerns itself with trying to understand and explain certain dimensions of them. Seen in this light, the epistemic quest as articulated by van Huyssteen is an entirely apt description of these sorts of manoeuvres.

Such criticisms not withstanding, van Huyssteen's undertaking represents a significant move forward in understanding the nature of rationality. Moreover, in effecting a critical shift in the centre of gravity with respect to epistemological parity, it provides a very different basis for engagement between science and theology. This, in conjunction with the evaluative tools and critical imperatives which come in its train, opens up interesting new possibilities for constructing dialogue between the two disciplines. These not only offer a way of overcoming some of the tensions discussed in Chapter 1 but also raise prospects for addressing the issues of noegenesis which were touched on earlier and highlighted in Montuori's questions at the chapter head. A consideration of the structure and mechanics of this 'transversal' style of dialogue, and of the possibilities of using these to further extend its reach, is the subject matter of the remainder of the chapter.

2.3 'Transversal' interdisciplinary dialogue

2.3.1 Encounter: the basis for transversal dialogue

The critical moment here is that van Huyssteen's reconfiguring of rationality moves the epistemological locus of interdisciplinary connection from the *specific methodological* to the *shared rational*: under the postfoundational rubric, commonality between the disciplines becomes located firstly in the problem solving activities which sit at the heart of all investigative traditions (Laudan, 1977:190); and secondly in their appropriation of the same tools of rationality for the prosecution of these, albeit within very different reasoning strategies. This move has a number of significant consequences from the dialogical perspective.

Firstly epistemological and cognitive parity becomes inherent not in an appeal to some universal guaranteed epistemology, but instead in the possession and employment of the skills and tools common to human rationality. Each discipline is therefore also answerable to the same epistemic standards – ones which are not domain specific but which are integral to the *nature of rationality itself*. Epistemology is thus no longer a strategic place of control between them, where a particular discipline acts as a 'border policeman' with a monopoly on verification and thus on knowledge (cf. Morin, 2008:28, 34). Instead the rational merits of ideas and positions, particularly as they are proffered as contributions to dialogue, are evaluated not with respect to a particular world view, or in terms of a perceived approximation to 'truth or 'reality', but against the standards demanded by a postfoundational understanding of rationality. These involve progress towards optimum intelligibility; the execution of responsible epistemic judgement for which suitable accounts can be articulated; an acknowledgement of the role of experiential accountability; and a willingness to both adopt a critical stance towards that which is rationally compelling and to open it up to critical evaluation outside of its disciplinary home. Such standards, along with the quality of epistemic humility which they entail, can arguably be regarded as providing a legitimate, transdisciplinary court of appeal for evaluating the rationality of any stance within any particular research tradition. In subsequent chapters, both the scientific and the theological contributions to each specific transversal dialogue will be evaluated in this way and their suitability as contributors assessed, along with any caveats raised in the light of these criteria which need to be born in mind.

Secondly moving the philosophical fulcrum for dialogue enables the epistemological and ontological tensions identified in Chapter 1 to be negotiated in a more positive way. In linking disciplinary likeness to the centrality of problem solving, it enables both recognition of the distinctive differences in scientific and theological approaches, and an acknowledgement of their validity. This frees theology from some of those difficulties identified earlier as arising when it has to cast itself in a strong critical realist mode as a prerequisite to dialogue. While the issue of criticality is not removed, the dynamics of postfoundational rationality present, as suggested above, a different framework within which specific theological positions and ideas can be evaluated from this respect, particularly in the context of being offered as contributions to dialogue. Furthermore, since this problem solving pursuit is no longer understood in terms of the uncovering of absolute truth, difficulties presented to both theology and to science by the pressures of claims either of having direct access to an independent reality, or of generating increasing verisimilitudinous accounts of it, are also reduced. In liberating theology from the need to transform itself into natural science or perpetually defend itself against dismissal as non-science, van Huyssteen's move also has significant further benefits for theology itself: firstly it enables concentration to be focussed on the development of theology's own unique perspectives; and secondly it provides a way, through cross-contextual and interdisciplinary engagement, of strengthening the rational redeemability of these, thus increasing their dialogical potential. Both of these can then feed not only into stronger dialogue, but also into paving the way for the recovery of a public voice for theology – something which van Huyssteen has long argued for (van Huyssteen, 2006:310). Once again it is also something on which I will be drawing in the course of producing the theological contributions to the thesis.

Finally, this relocation of epistemological parity enables and facilitates a move away from any need to try and establish over-generalised blueprints for how to 'do' science/theology dialogue. Instead of forcing all such efforts into a pre-cut die, it now becomes possible to focus instead on defining specific loci for engagement in terms of the very specific science and very specific theology which might be usefully engaged: the nature of the model, as will become clear in the following section**,** allows for the identification and development of precise dialogical intersections, thus increasing the chance of fruitful outcomes. From the specific

perspective of pursuing neurotheological dialogue, this economy of delimitation also offers a solution to the problem identified in Chapter 1 of potential territorial vastness. Simultaneously, the standards of accountability inherent to postfoundational rationality provide a way of assessing the suitability of specific voices as potential dialogical partners at such intersections. This opens up a way to approach the dilemma of 'which voices?' that was raised in Chapter 1, thus further enhancing the prospects for developing coherent and potentially fruitful engagements.

The combination of re-envisaged parity and the resultant shift away from abstract dialogical models, by allowing the recognition of legitimate difference, also helps to minimise the pressures for reductive or assimilative manoeuvres. This in turn reduces the need for reflex adoption of defensive positions and instead frees dialogue to explore in a more unfettered way the dynamics of challenge. This removal of assimilative pressure also enables a fuller actualisation, in the context of interdisciplinary dialogue, of the transversal imperative to stand in critical relation to that which we find rationally compelling. There is thus the possibility of moving, not just beyond apologetics into enriching or expanding specific disciplinary understandings, but also of pushing disciplinary limits themselves.

In essence then, taking a postfoundational account of rationality as a starting point leads to a set of dialogical dynamics which are very different from those of more traditional models. This allows van Huyssteen to then develop and model a way of pursuing dialogue between science and religion which is very different in its aims, mechanics, and outcomes to those which have so far been the mainstay of the field(van Huyssteen, 2006).

2.3.2 Exchange: the mechanics of transversal dialogue

Van Huyssteen's model is basically conceived and executed using the ideas and language of transversality which arise from his explorations of rationality. This finds form in two important ways: firstly through employing a notion of transversal reasoning by which dialogue is facilitated; and secondly in the delineation of what van Huyssteen terms 'transversal spaces' in which dialogue can be located.

Transversal reasoning is essentially coterminous with the transversal performative dynamics at the heart of postfoundational rationality examined in section **2**. In summary, these are the skills, which through the cognitive fluidity they enable, allow us to gather and bind together the patterns of our experience; to set these

within the wider contexts which enmesh us; to recognise the extent to which these shape our interpretations; and through discernment and articulation, to give account of that which we take to be rationally compelling. In interdisciplinary exchanges these same skills enable us to work, again under the direction of the associated dynamics of epistemic responsibility, in and across the intersections of very different disciplinary discourses as they come together in dialogue. Under the operations of transversal reasoning, questions of asymmetry and hierarchy become, as I have argued above, non-issues since interdisciplinary dialogue is opened up in a way which identifies the various contributory voices, whether from science, theology or other disciplines, as different but equally legitimate ways of looking at the world.

Transversal reasoning thus allows us to move from context to context, across different disciplines and research traditions in search of what van Huyssteen terms 'a wide reflective equilibrium' (van Huyssteen, 2006:31). This in no way implies that complete consensus is a necessary endpoint but is instead the fragile communal understanding which we might be capable of achieving in 'the transversal moment' (van Huyssteen, 2006:219). An essential element of this process of moving across boundaries is the actualisation of what I would term the 'transcendence-in-rootedness' which transversal dynamics facilitate. Essentially this is the ability to retain a sense of being connected to our disciplinary commitments and beliefs and yet simultaneously to be able to consciously move beyond their constraints. In other words it is a recognition that that we are not cultural prisoners of these contexts but are able, using the tools of transversal reasoning, to cross boundaries and explore other perspectives.

This dynamic of *moving beyond* is vital if we are to gain the maximum benefit from the interdisciplinary encounter. However this is not simply about allowing ourselves the possibility of being enriched by the insights, theories, or evidence that a different discipline finds to be rationally persuasive. It is also a recognition of the fact that, under the epistemic imperative of postfoundational rationality, we have an obligation to also stand in critical relation to our beliefs and the traditions and worldviews which give rise to them; and that one of the arenas in which critical reflection can shape disciplinary identity and endeavour is in the transversal spaces of interdisciplinary encounter. As I have argued above, the freedom

from competitive and assimilative pressures which van Huyssteen's model entails, not only provides the security to experience and explore the riches and the challenges of interdisciplinary dialogue, but also makes it dense with possibilities for fruitful outcomes.

That freedom is also a function of the second feature of van Huyssteen's model: this is the creation of a unique and distinctive location in which the complex many levelled connections and exchanges facilitated by transversal reasoning occur. Although he does not provide much in the way of detailed development, this is an integral part of and a key element in the model's rich potential. The essential and unique feature here is that this dialogical locus is situated not within the confines of any one contributing discipline, but in what van Huyssteen labels 'transversal spaces' sitting between them at their 'porous boundaries' (van Huyssteen, 2006:9, 43). As such they do not *belong* to any of the participating disciplines and thus they are not constrained by any of their particular features *vis-à-vis* epistemological strategies or particulars of proof. In this respect I believe that they can appropriately be conceived as *liminal* spaces – Turner's 'realms of pure possibility' (Turner, 1967:97) – with all the openness of outcome possibilities that this implies.

Rather than being a disciplinary construct, transversal spaces can more usefully be thought of as being a *shared rational space* – in fact it is the very nature of a dialogue predicated on the tenets of postfoundational rationality which generates them. It is also what sustains them as places where the different disciplinary voices can operate with a freedom from the assorted constraints which characterise other models. Both their shape and structure, and the freedom they confer, are a direct consequence of the shift in the ground of connection already outlined, and the related translation of epistemic standards to those which inhere in rationality itself rather than in any particular methodological approach (p **3.2**). The net result of this is that the voices contributing to dialogue need no longer be seen as in contradiction or competitive; neither need they be suspected of being predatory in a reductive or assimilatory way. This then allows a dynamic of interaction which can be both expansive and challenging for the participating voices. From a neurotheological perspective, such spaces would thus seem to provide an ideal way of accommodating Newberg's insistence that neither the assumptions

of science nor those of theology are to be taken as normative. While this does not necessarily solve the problems earlier identified for the production of a distinctive neurotheological perspective, I believe the use of transversal spaces can be further developed to address this aspect (see further at 2.4 below).

In identifying potential locations where transversal spaces might be generated, the metaphor which van Huyssteen draws on is Schrag's mathematically informed picture of a line intersecting a system of other lines or interfaces (Schrag, 1994:64; van Huyssteen, 2006:20). The idea here is one of convergent paths moving towards an imagined vanishing point – the transversal space. The nature and abundance of human experience is such that there is the likelihood of many such intersections between different discourses. Locating these potential intersections can take a variety of forms – for example the identification of common interests or shared research foci; alternatively phrases in common currency in different disciplines may flag up potential overlaps and thus point towards the possibilities of generating transversal spaces (van Huyssteen, 2006:9). Once such possibilities have been identified then further specification may be deemed necessary. In fact van Huyssteen himself sees the ideal standard in extremely refined terms – involving specific theologians attempting to do very specific theologies, entering dialogue with similarly designated scientists, working within specified sciences on clearly defined, shared problems (van Huyssteen, 2006:5).

Osmer (2006:343-4) has suggested that a weakness of the model is that there is no clear 'principle of selection' by which to justify why specific persons or perspectives are engaged in dialogue. He sees this as leaving it vulnerable to two charges: firstly, that those who participate in such dialogues need not engage with anything which challenges their viewpoint; and secondly that there *is* a selection principle but it is methodologically covert. However van Huyssteen makes it clear that prior agreement is not a *sine qua non* of attempting transversal space dialogue (van Huyssteen, 1999:274; 2000:430; 2006:9). On the contrary, he follows Rescher's argument that we should not be looking to consensus as the ultimate epistemic touchstone since dissensus and diversity play key constructive roles in human interaction (Rescher, 1995:6-7; van Huyssteen, 1999:270). There is also no suggestion that congenial dialogical partners should be privileged – something which is anyway, in complete antithesis to the criticality which is central to both

postfoundational rationality and to the model itself. With respect to the second possible problem, the selection principles inherent in the creative identification of possible transversal spaces and the need for epistemic accountability of dialogical contributions are arguably completely in keeping with the combination of openness and accountability which comprise the model's great strengths. Moreover the delineation of a rigid set of rules governing selections would seem to be not only against the nature of the model itself, but also likely to close down the possibilities for more imaginative or oblique connections – with all the surprises which might potentially flow from these.

Essentially then, safeguards against both an avoidance of risk and a privileging or protecting of material are built into the model through the dynamics of postfoundational rationality itself: the themes of responsible judgement, lucid articulation of the justification for holding something to be rationally compelling, and the willingness to adopt a critical stance towards this, have already been expounded as key elements of the metric. Thus for material to be suitable for the kind of exchange envisaged in transversal spaces, it must first of all be shown to be rationally defensible as this concept is understood within the rubric of postfoundational rationality. The difficulties for dialogue presented by unquestioning fideism have already been noted and are heightened in the light of the dynamics of transversal space dialogue in which no belief can claim a privileged status with respect to interrogation. In this respect it is also worth noting that though dialogue may begin with willingness to take a critical stance on one's own contribution, its course may subsequently present challenges which precipitate a withdrawal into dismissive or protective stances. However any such manoeuvres disrupt the transversal space and thus effectively terminate the dialogue. Thus once again the basic nature of model simultaneously furnishes safeguards for it.

A final point here concerns the bringing of material from very different explanatory and reasoning strategies into a dialogical space which is relatively unregulated, at least from a disciplinary perspective: it is of vital importance to the integrity of the transversal exchange and the success of dialogical outcomes that scrupulous attention is paid to the meaning of words and concepts as they are employed by the contributing disciplines (van Huyssteen, 2006:9). Taking words or concepts out of context to support the arguments of another discipline tends, un-

surprisingly, to be seen in a poor light (e.g. Brothers, 2002b:862-3) and may, as already noted in Chapter 1, present a particular issue for theology with respect to science (Drees, 2010:58-9; Polkinghorne, 1999:151-8). It is also a very present potential danger in the current project, dealing as it does with concepts (such as emergence) which are all too easily appropriated as ubiquitous explanatory paradigms, and experimental data (for example on brain scans) which are often in danger of being over-interpreted. In light of this, close attention will be paid in each conversation to conceptual appropriation as well as to the limits of experimental data. As such this obviously also represents part of the criticality towards contributions entailed in the model.

Transversal spaces are thus dynamic places of interaction, based on the shared tools of rational enquiry and coming into transient existence as part of a cross-disciplinary engagement on a specified topic. The freedom they entail allows for mutual influence and critique – the exchange of ideas and insights, models and reasoning strategies, in a non-assimilative and a multidirectional manner. Generally speaking, boundary transgression, particularly with respect to the borders between the natural sciences and humanities, is viewed as a subversive undertaking (Greenberg, 1990:1). Van Huyssteen's model, by restructuring specific boundary intersections as liminal spaces under the governance of shared postfoundational rationality, turns it instead into a potent driver in the quest for optimal understanding of a given issue. As such then, his model more than fulfils the first of the methodological criteria which I earlier suggested were necessary for a neurotheological engagement *viz.* the facility to enable a free and fruitful exchange between the very different perspectives of neuroscience and theology. However a second requirement – that of being able to generate a distinctively neurotheological output – was also specified. It is therefore necessary, when assessing the model's suitability for purpose, to also consider the sort of dialogical outcomes it might be capable of generating.

2.3.3 Expression: the outcome of transversal dialogue

As his repeated reiterations make clear, van Huyssteen regards the outcomes of any multidisciplinary transversal engagement to be essentially *inter*disciplinary (van Huyssteen, 2006:35,39,40,159,273,307,323). That is to say, the output trajectory of the transversal space dialogue is always downwards back into the contributing disciplines to enlarge, clarify or challenge their respective

understandings of the area under exploration. Hence the scientist and theologian 'return to the boundaries of their disciplines to consider the interdisciplinary results of the multidisciplinary conversation' (van Huyssteen, 2006:264). Van Huyssteen sees this as taking two possible forms: the enrichment of existing understandings, and expansion into new territory. Thus he talks in terms of other disciplines providing 'clues, challenges, criteria, or other forms of persuasive evidence that will help us *push the limits* of our own disciplines' (van Huyssteen, 2006:309, emphasis mine); he also raises the possibility of making 'new and exciting discoveries' at the boundaries between disciplines (van Huyssteen, 2006:9) – though such discoveries are still essentially *disciplinary* in nature. These are clearly valuable outcomes and ones which, when taken in conjunction with the other key features of the model as I have discussed them here, promise a rich potential harvest for theological thinking.

However apropos of the particular issues for science/theology dialogue which have been discussed both here and in Chapter 1, this approach to outcomes means that arguably the model, for all its strengths, may ultimately still fail to negotiate the disciplinary imbalance previously noted. Thus the theologian is seen as using a transversal dialogue 'to enrich current research in theology' whilst at the same time maintaining conversation with scientists 'interested in the broader religious or specific theological perspectives that theology might bring to the table' (van Huyssteen, 2006:270). However it is much less clear how the same dialogue feeds into enriching scientific research or thinking and hence the question as to what precisely theology contributes to such dialogue still lingers. This sense is heightened by the terms in which van Huyssteen summarises the results of his own multidisciplinary exploration of human uniqueness: here he describes 'the most important interdisciplinary result' as being the powerful revisioning of the theological notion of the *imago Dei* which has resulted from the scientific contributions. Arguably this is not surprising since van Huyssteen is writing as a theologian; however, and despite the richness of the preceding explorations, there is still an inescapable asymmetry in the terminology with which he subsequently describes the different outcomes for science and theology consequent upon the transversal dialogue he has undertaken (van Huyssteen, 2006:322-3).

This raises questions as to whether the model is capable of facilitating the production of the distinctively different discourse which Newberg claims as being the hallmark of neurotheology. As I suggested in Chapter 1, for such a concept to have any traction, then alongside disciplinary enrichment, any dialogue between theology and neuroscience also needs to develop an output which is separate from, and distinctively different to, an expanded scientific or theological account of a phenomenon. Newberg is somewhat opaque as to the form this might take; furthermore, despite the vision presented in his *Principia,* the case remains to be made as to precisely *how* the discipline can facilitate both a non-reductive exchange and an integration of perspectives to form a new and distinctively neurotheological viewpoint on any issue under investigation. As the arguments of previous sections have demonstrated, employing van Huyssteen's postfoundational methodology provides a way of doing the first of these; I believe that with a further development, it can also become a means to achieving the latter. In order to undertake the planned neurotheological exploration of relationality and health, I therefore propose to employ an extension which I believe to be a natural consequence of the epistemic imperatives which drive the basic model. As such it is in harmony with both the intrinsic nature of this model and the postfoundational rationality which undergirds it. It is also totally in keeping with the liminal nature of transversal spaces that they can give rise to novel configurations of ideas and relations of the kind I am envisaging here. In the following section I will discuss how these features all combine to support the generation of what I will designate as 'transversal outputs'. These take the form of rationally and epistemologically defensible composite arguments and models which combine the insights and data of both disciplines without either reduction or improper blending. Thus I believe they can legitimately be designated as being distinctively neurotheological in nature.

2.4 Developing the transversal dimension

As already noted, van Huyssteen makes it clear that the envisaged output trajectory from the transversal space is downwards, back into the contributing disciplines. What I want to consider here is whether, under appropriate circumstances, the model can also support the possibility of an additional output trajectory – one

which involves not a move *back* into the contributory disciplines, but instead a move *beyond* them.

2.4.1 Generating transversal outputs

In light of the dynamics of both postfoundational rationality and transversal dialogue as they have been explicated in this chapter, a good case can be made that in some instances such additional outcomes could indeed be generated alongside any specific interdisciplinary ones. The trajectory envisaged for these would not be back into the participating disciplines but instead would lie between and beyond them in a way not dissimilar to the spaces themselves. As such they would therefore, like the dialogue which engenders them, exist and be supported in the shared rational space between the disciplines. Hence they too would neither belong to, nor be fully constrained by them. Clearly any such arguments and models would be neither strictly 'scientific' nor 'theological' in their formulation and expression. Instead, drawing on and knitting together disparate material brought into the transversal space by the contributing disciplines, they could appropriately be designated as 'transversal'. Similarly, just as with the transversal dialogue, they would not be answerable to the *domain-specific* epistemic standards of the contributing disciplines, but to those which inhere in postfoundational rationality itself as set out above. Essentially then, the argument here is that the model's inherent characteristics validates the attempt, where appropriate, to use the different disciplinary contributions to build *composite* arguments and models. Indeed to do so is actually a logical development of the model itself – standing in direct continuation with the dynamic operations of both transverse rationality and the transversal space interactions themselves. Thus it receives both sanction *and* support from the model's two central elements.

With respect to the first of these, as extensively discussed in sections 2.2.1 and 2.3.2 above, a postfoundational understanding of rationality sees it as a set of practical skills whose hallmark is a certain cognitive fluidity. These enable us to identify, explore and bind together different elements and patterns in our assorted experiences. In interdisciplinary exchanges these same skills enable us to work, under the direction of the associated dynamics of epistemic responsibility, in and across the intersections of very different disciplinary discourses as they come together in dialogue. This allows the identification of places of actual and potential connection and attention to the possibilities inherent in these for in-

creasing understanding of the topic under consideration. However this self-same cognitive fluidity can also be employed at a more *meta* level to range over and above *these* different developments in the transversal space dialogue; likewise the same practical skills of transversal rationality can be used to evaluate, take up, and connect elements from different discourses which are held in the transversal space as part of the interdisciplinary dialogue. In effect then this is simply the same dynamics and skills being engaged in connection with a different constellation of thought and action – that which belongs to the 'situated experience' of a specific transversal space dialogue. It thus represents a natural extension to van Huyssteen's 'first movement of transversal rationality' i.e. that of identifying and evaluating viable and productive connectional possibilities in specific interdisciplinary conversations (van Huyssteen, 1999:137). It is also completely in keeping with the anticipative nature of rational articulation (p49) through which it identifies and marks out new possibilities for both discourse and praxis.

The development of transversal outcomes can also be seen as being driven by another integral element of van Huyssteen's refiguring *viz.* the pursuit of the epistemic quest. In the postfoundational perspective, this is conceived in terms of optimal understanding, realigning progress in this regard with improved problem solving ability, rather than with correlation to 'absolute truth' (see p51). Such a reconfiguration furnishes both imperative and warrant to use the skills of rationality to pursue different possibilities for achieving these goals. Moreover it means that any resulting transversal argument or model can be evaluated by these same standards of optimised understanding and improved problem solving, rather than by specific epistemic standards such as those, for example, which attach to the scientific method. Thus the development of transversal outputs merely represents an extension of the cognitive skills of postfoundational rationality which already undergird and facilitate van Huyssteen's dialogical model. Moreover the model's own internal regulation makes the development of transversal outputs of various kinds not only an obvious but also a reasonably secure course to pursue in this regard.

The second key element offering validation and support for suggesting such an extension is the actual mechanics of the model itself, particularly as they act as critical filtering mechanisms: firstly the nature of the transversal space model is

such that any dialogical ground is already fairly specifically delimited. This pre-selection of closely intersecting interests, even if dissensus is the predominant voice, increases the likelihood of discovering elements from different disciplines which might be connected to yield transversal outputs. Moreover, as I have argued above, the identification of just such possible areas of fruitful connection is a key skill of transversal rationality. This dynamic and its associated skills could also arguably be extended to facilitate pre-identification of those conversations in which the development of a transversal output might conceivably be either an appropriate course to actively pursue or a likely spontaneous outcome. In this instance, one possible scenario might be where a question has been raised in one or more of the contributing disciplines which cannot be completely answered from within *any* of them. In fact it is just such a situation which I wish to explore in this thesis with respect to whether and how relational connection might affect health outcomes. As I will suggest in the following chapter, although evidence from a variety of different perspectives indicates a connection, the mechanisms cannot be directly elucidated from either the scientific or the theological perspectives. However the contention underpinning my second research hypothesis is that even in the absence of direct evidence, it may still be possible through multidisciplinary dialogue, to explore this link, and to develop a transversal argument for such a connection with an accompanying model for a possible mechanism.

Another key feature of the model which also facilitates the development of transversal outcomes is the epistemic standards which are applied both prior to and during the course of transversal conversations. As has already been discussed one of the criteria for engagement is that contributory positions need to demonstrate that material intended for this is suitably accountable to the standards of post-foundational rationality and thus displays the features of responsible judgement and a fallibilist approach. Moreover whilst strong convictions may be brought into dialogue, it is an imperative that such convictions are not offered privileged protection but must be open to critical evaluation as a part of such dialogue. Thus at various levels of the dialogical process, there is a winnowing of data, theories, and models through the mechanisms associated with epistemic responsibility. This allows various elements which might be incorporated into a planned transversal output to be evaluated against the standards of rational and epistemic accountability inherent in the model; this in turn gives a confidence that for any proposed

output, a suitably robust account of its defensibility in these respects can be articulated.

The notion of defensibility leads to the issue of what warrants might be offered in support of both the general concept being developed here and for any specific transversal outcomes which might be generated from a transversal space dialogue. Here once again the twin dynamics of postfoundational rationality and of the model itself hold the key through the nature of evidential support for beliefs and claims which these enable.

2.4.2 Transversal warrants

As discussed earlier (p56ff) van Huyssteen draws on Haack's foundherentism as a way of developing a postfoundational account of the connections between experience and how we justify the beliefs arising from this. Haack uses the idea of the crossword puzzle to argue a case for the feasibility of developing legitimate mutual support between beliefs which avoids circularity (Haack, 2009:126ff). The same analogy can also be used both to support the development of transversal models and arguments generally, and as a way of assessing the relative coherence and strength of any specific one. Here it is important to state something about the nature of the transversal developments proposed: what is envisaged is not the uncritical transfer of theological convictions into science to function as 'data' within its systems; neither is it a reverse flow which places theological agendas under the direction of science. Indeed Van Huyssteen has rightly cautioned against both such manoeuvres within transversal space dialogues (van Huyssteen, 2006:323-4). On the contrary, what is key here is that the different contributions are *in no way* envisaged as operating in a 'god-of-the-gaps' type manner. Hence this is not a case of theological perspectives plugging holes in the scientific data or vice versa. Instead different disciplinary perspectives interlock to provide the sort of 'pervasive relations of mutual support' for a thesis which Haack (2009:57) describes. In this way it is envisaged that arguments and models may be built in response to particular questions, even in the absence of direct definitive evidence from within a particular discipline, on the basis of mutually supportive, albeit radically different types of evidence.

It is here then that the applicability of Haack's crossword analogy becomes clear. The plausibility of a crossword entry depends on various things: how well it fits

with both its clue and any intersecting entries, how plausible these latter are *independent* of the entry in question, and on how much of the overall crossword is completed. Similarly, the relative strength of a claim depends on how supportive the evidence actually is, how secure this evidence is independent of the claim in question, and how much of the relevant evidence it includes (Haack, 2007:24). In other words the key features required in building a convincing case are supportiveness, independent security, and comprehensiveness, where supportiveness is not categorical but a matter of degree (Haack, 2007:66). Translating this to the context of the proposed transversal arguments and models: different contributions to a specific transversal space dialogue (which thus potentially come from different disciplines) can be seen as standing for the different entries in the puzzle and as offering support for other possible entries to be added, even if the clues leading to these are not always completely clear.

Assessment of the evidence supporting each of these individual entries comes from the operation of the tools and dynamics already described, at both disciplinary and transversal level. The degree of confidence with which each such entry can be made is likely to be variable and thus whereas some answers may be 'inked in' with a fair degree of certainty, other elements of the model being built may remain rather more provisional 'pencilled' entries, subject to revision at a future date as more data are accrued or ideas develop further. This however is completely in keeping with the dynamics of epistemic responsibility entailed by postfoundational rationality and it addresses moreover the issue of obsolescence raised in connection with Ashbrook's approach. Indeed Haack herself uses the picture of a giant crossword with many entries blank, some completed in indelible ink, others in regular ink, still others pencilled in and repeatedly rubbed out, to describe how the growth and integration of the body of scientific knowledge itself proceeds (Haack, 2007:93-4). Over and above this method of evaluating the strength of any proposed construction, transversal models can also be judged on the same criterion as those which Laudan proposes with respect to scientific progress generally: the degree of conceptual clarification enabled, and the balance achieved between resolving/generating empirical and conceptual problems. Such indicators of the coherence and usefulness of any particular argument or model thus generated are also completely consonant with the conceptualisation of epistemic accountability expounded here.

My argument is thus that the proposed development of van Huyssteen's model is not only a natural extension of its normal workings, but also one demanded by the imperatives of the epistemic quest which the model serves. Furthermore, the skills employed in the identification and construction of transversal outcomes are those which are already at work driving the dynamics of the model as it currently operates. Indeed one could argue that both postfoundational rationality and transversal space dialogue *already* straddle the border between *inter-* and *trans-*disciplinarity, and that this development and the possible results which might ensue moves this approach to dialogue decisively into the growing territory occupied by transdisciplinary approaches. As Montuori's challenge indicates, such approaches to the understanding and integration of knowledge – the development of 'complex thought' (Morin, 2008:2-6) – are an urgently needed response to the growing complexity, uncertainty and ambiguity of the current times.

2.4.3 Transversal models as a form of transdisciplinary enterprise

Although there are differences between different models of and approaches to, transdisciplinary endeavour, they are united in addressing the fragmentation of knowledge caused by disciplinary specialisation. The resulting insulation and isolation this leads to not only allows key realities to be disintegrated and 'slip through the cracks between disciplines' (Morin, 2008:2-6), but also proves inadequate for understanding and responding to the increasing complexities of the world. Transdisciplinary approaches have a history stretching back at least as far as the work of Jantsch (1972) and Piaget (1973). More recently the work of writers such as Morin (1992:371-85; 2008) and Nicolescu (2002:110-3; 2005; 2008:1-22), the establishment of an International Centre for Transdisciplinary Research (CIRET) and a Charter of Transdisciplinarity (de Freitas *et al.*, 1994) have all fuelled a gathering interest in approaches which cut across orthodox disciplinary boundaries to work against the segregations and disjunctions imposed by relentless disciplinary subspecialisation. Such approaches are now linked with comprehensive paradigms (e.g. Marxism), broad interdisciplinary fields (e.g. cultural studies) and synoptic disciplines (e.g. geography) as well as being a major imperative in a wide range of academic discussion forums, websites, and conferences (Thompson Klein, 2004:515-6). In short transdisciplinarity is becoming a major mode of thought and

action (ibid:524) even though conceptual, institutional, and social barriers to its continued progress still remain(Lawrence and Després, 2004:398-9).

Although van Huyssteen never appropriates the term himself, there are in fact many similarities between transdisciplinary approaches and the dynamics of post-foundational rationality: for example transdisciplinary approaches involve context-specific negotiation of knowledge (Thompson Klein, 2004:521), practical reasoning (Horlick-Jones and Sime, 2004:445), and communicative praxis (Després *et al.*, 2004:476-7), all of which find ready echoes in van Huyssteen's work. And whilst Després looks primarily to Habermas' theory of communicative action to inform the associated 'post rationalist approach to knowledge building', there are strong similarities between this and the postfoundational rationality expounded in this chapter. Moreover van Huyssteen's dialogical model itself also sits very comfortably within the umbrella of transdisciplinarity. There are strong resonances for example with Després' description of the search for 'convergent interpretative schemes' or of the 'mediation space' opened in transdisciplinary boundary crossing and the specific activities, such as the definition of complex research objects and questions, which are located there (Després *et al.*, 2004:475). The proposed extension also provides one possible way of addressing the difficulty of interfacing 'hard' and 'soft' disciplines: in epistemological terms, transdisciplinarity involves integration of different knowledges (Horlick-Jones and Sime, 2004:444). But whereas integration across the boundaries of 'hard' disciplines such as physics and chemistry is well established (ibid:445), there has been a tendency to sideline concepts and approaches that are incompatible with 'hard' knowledge (Thompson Klein, 2004:520). Van Huyssteen's model provides a methodology which is ideally suited to transdisciplinary engagement between very different disciplines and the extension I propose provides for the possibility of integrating these to form a transdisciplinary output.

Seen in this light, neurotheology can then be understood not as a hybrid *neo-discipline* but as transdisciplinary *venture* – something which has a number of important effects: it helps it to avoid the trap (and associated epistemological constraints) of becoming restricted to the neurobiological study of the cognitive markers of different aspects of religious life and thought, and allows it instead to become the neurotheological study of humanness. This then means that theology

can contribute more than simply the providing of better definitions of spirituality, or improved design for studies of brain activity in connection with religion to which Newberg's approach seems to relegate it. As I suggested in Chapter 1, this would be to potentially waste much of what theology could bring to the enterprise. The neurosciences are generating vast amounts of experimental data – much of which challenges long held folk ideas about personal identity and the existence of the soul, free will and intentionality, morality and responsibility etc. Since theological thinking has always concerned itself with *anthrōpos,* such themes have long been reflected on within its different systems. Thus whilst clearly standing to gain insight from such neuroscientific data, theology also has much to contribute towards expanding understanding in such arenas. Van Huyssteen's model allows for both bidirectional interdisciplinary enrichment, and the possibility of transdisciplinary expansion of knowledge in response to specific questions, beyond that which either discipline could reach alone. It is the latter route which this project will follow in its neurotheological exploration of relationality and health. In the final section, I will thus give a brief outline of the purpose and planned development of the project, indicating how I intend to use van Huyssteen's model to facilitate this.

2.5 Constructing a transversal neurotheological investigation

We live in an age which is increasingly information rich but knowledge poor. This is a multifaceted problem but the aspect of interest here is the combination of an explosive growth in data generation of different kinds, and the constraints imposed by the continuation of modernity's influence on disciplinary structure and epistemological enclosure. The challenge is thus not necessarily in gathering information, but in making sense of that which we have. From this perspective, interfacing disciplines such as neuroscience and theology, whilst it presents enormous challenges, also has the potential for rich rewards. In this chapter, I have suggested that van Huyssteen has provided a very different way of both meeting the challenge and reaping the harvest. It is this route which I intend to follow in this thesis with a view not primarily of disciplinary enrichment, but to formulating a transversally derived understanding of the connection between relationality and health.

The intent here is to explore the connection between the quantity and quality of relational connections and health outcomes as these might be mediated by alterations in immune functioning. The research thesis under investigation is that how we express and experience relational connection has the capacity to *directly* moderate immune functioning. Epidemiological and immunological data are strongly suggestive of such a connection but neither can, of themselves, furnish sufficient warrant to claim a causal link; neither can they, alone or in combination, definitively establish its mechanism. What I will set out to do in this project will therefore be to build the argument transversally. To do this I will use experimental data from cognitive neuroscience and psychoneuroimmunology, in transversal conjunction with theological reflection on various aspects of relationality. The primary transversal intersection between the three disciplines is thus the notion of relationality, but within this three separate loci for interaction have been identified: relationality as basic, relationality as emergent, and relationality as realised.

Each of these will take the form of a transversal space encounter in which targeted contributions from the dialogical partners in different combinations will be brought together transversally. Material will be selected and justified according to the criteria laid out in this chapter and any appropriate caveats, such as the limitations of experimental data, will be noted. Theological material presented will comprise insights on aspects of human relationality generated within Christianity but which are not ultimately dependant on a concomitant accession to particular faith propositions. Each conversation will generate, through the interlocking of information described above, a transversal outcome to be carried forward. These outcomes will then themselves be integrated in the same way to build a composite transversal argument that how we express and experience our capacity for relational connection can *directly* modify immune function and thus affect health outcomes. Finally I will use the transversally generated material to construct a theoretical model suggesting a possible physiological pathway by which such a connection could be mediated.

Firstly though it is necessary to establish that an interest in the connection between relationality and health is a sufficiently strong point of intersection between the three disciplines to generate and support a transversal space within which to situate the proposed dialogues. This will be the work of Chapter 3.

Connections and Causes

Exploring the links between sociality and health

> Jesus reached out his hand and touched the man […] Immediately he was cleansed of his leprosy.
>
> (Mt 8:3)

> Social relationships have a predictive, arguably causal, association with health.
>
> (House *et al.*, 1988:544)

> The link between personal relationships and immune function is one of the most robust findings in PNI, spanning diverse populations and stressors.
>
> (Kiecolt-Glaser *et al*., 2002a:21)

3.1 Introduction and outline

The intimation that a close connection exists between aspects of social status and health outcomes is a longstanding one; and the formal recognition of social variations in morbidity and mortality has existed since 1662, when John Graunt analysed deaths in London parish records and noted significant variations both between the sexes and between urban and rural dwellers (Graunt, 1662/1939). Early studies of the nature of such variations focussed primarily on poverty, poor housing, and work environments. However following publication of Durkheim's seminal work on suicide (Durkheim, 1897) social integration also came into focus as another potentially important factor in health outcomes, and it is now widely recognized that social relationships and affiliation have powerful effects on both physical and mental health (Berkman *et al.*, 2000:843). Social epidemiology, the study of 'the social distribution and social determinants of states of health' (Berkman and Kawachi, 2000:6), has played a leading role in exploring this impact of social relationships on health. Connections between social factors and disease have also been extensively studied, in a somewhat different way, by the emerging discipline of psychoneuroimmunology (Daruna, 2004:117-78). A presentation of the relevant data from both of these disciplines will form a central plank of the current chapter, alongside an account of biblical motifs connecting social integra-

tion and health. The aim here, in keeping with the transversal methodology outlined in Chapter 2, is to establish from a variety of intersecting perspectives the existence of a connection which invites and would be illuminated by a neurotheological exploration.

In the opening chapter it was suggested that whilst the idea of 'improv[ing] our understanding of the human condition particularly in the context of health and well being' (Newberg, 2010:18) was a legitimate arena for neurotheological endeavour, the assorted difficulties inherent in reading epidemiological data linking religion/spirituality to health warranted the exploration of other approaches to investigation. The alternative proposed in this thesis is that, given the important role which relation plays in religious narratives generally, and the strong connections between social relationships and health which are implicit and explicit in both Old and New Testament texts, then undertaking a neurotheological exploration of the connections between *relationality* and health would form a useful, complementary endeavour to set alongside that of investigating the links between *spirituality* and health (and indeed that there might be some strong areas of overlap between these two). The reviews in this chapter thus aim to establish that this a legitimate arena for a neurotheological investigation and synthesis using the transversal methodology developed in Chapter 2. This requires the demonstration of two things: firstly, that a firm enough ground exists to substantiate a claim of significant connection which warrants further exploration. Secondly, that there is a sufficiently strong intersection between theological and neuroscientific interests in the topic to generate and sustain the formation of a transversal space within which a dialogue between the discourses can be conducted.

In order to provide a framework of understanding within which the proposed neurotheological explorations can be set and against which any resulting model can be read, it is also necessary to address the issue of health itself. However the concept is complex and chimeric and hence achieving a precise and satisfactory definition is somewhat akin to chasing a mirage. The chapter thus begins with a brief exploration of this issue, especially as it pertains to the investigation of social influences on health. A wide variety of models of health and illness have been proposed but it is beyond the scope of the chapter to review all of these. The focus is therefore on the two which currently predominate in Western medicine *viz.* the

biomedical and the biopsychosocial, and on their very different *Weltanschauungen.* A brief delineation of their key features is followed by a consideration of the related perspectives of conceiving health in terms of either mechanical breakdown or as a disruption of the life-world. One of the contentions of this thesis will be that, in the case of relationality and health, these two are in fact organically related, with distortions of relational connection leading directly to degradations in endocrine and immune function.

The central sections of the chapter then deal with data presentation and the consequent establishment of connections: section 3 gives an overview of key motifs and themes in Biblical texts dealing with social integration and health. The following section examines the epidemiological evidence supporting a link and outlines possible pathways for the transmission of the observed effects. Out of these potential candidates, that of a physiological pathway is then taken up in section 5 with the presentation and assessment of various PNI data linking social interaction with alterations in endocrine and immune function. Since such data are extensive, these reviews are indicative rather than exhaustive; moreover they do not offer detailed analyses of the individual studies. However, in keeping with the imperative for criticality enshrined in postfoundational rationality, they examine some universally relevant methodological and interpretive issues from a general perspective. As with the theological contribution, specific aspects of these studies will be taken up and further explored through the transversal dialogues of later chapters. The final section then considers issues arising from these epidemiological and scientific contributions connected with the attribution of causality and the exploration of causal mechanisms. I suggest that constructing a transversal space dialogue between theology, immunology, and neuroscience might be a way of both addressing some of these issues, and of illuminating one possible causal chain connecting relationality and health.

3.2 Health and illness

3.2.1 Defining the terms

Health and illness are part of the universal human experience – we are, as Sontag (1978:1) observed, almost invariably 'passport holders of both domains'. Indeed it could be argued, following Nietzsche, that the latter condition is a defining fea-

ture of humanness (Morris, 1998:1). Yet the concepts themselves are strangely resistant to precise and satisfactory definition. The tacit assumption that health is a state in which there is no experience of disease belies the reality that the terms 'health' and 'illness' actually represent a nexus for a wide variety of understandings and perspectives. Moreover, we often only know or think about health in terms of its disruption by illness: it is, on the whole, an unexamined state, taken for granted until threatened. Hence health is often defined in the negative and much of the discussion concerning it is actually conducted through consideration of the concepts of illness – a point perfectly illustrated by the term 'ill-health'.

Various other factors also contribute to making the possibility of a circumscribed and universal understanding something of a mirage. For example definition also depends on who is articulating it: patients and physicians may have very different understandings of what constitutes 'good health' (Goldsmith, 1972:213; Helman, 2007:121; St Claire *et al.*, 1996:511-6). Furthermore, for any one person, the conception is likely to change with the alteration of external variables, with the passage of time, and with experience of illness (Blaxter, 2001:21-7; Radley, 1994). Finally the notion of health has been somewhat distorted by an increasing tendency to medicalise normal aspects of life: birth (Johanson *et al.*, 2002:892-5), adolescence (Timimi, 2004:1394-6), ageing (Ebrahim, 2002:861-3), sexuality (Hart and Wellings, 2002:896-900), and unhappiness (Double, 2002:900-4) are amongst a variety of 'conditions' for which people now demand and expect treatment.

The extent to which this latter phenomenon simply reflects the inexorable advance of an 'information-rich' consumerist culture is debated (Bonaccorso and Sturchio, 2002:910-11; Mintzes, 2002:908-9), and it has been argued that technologies such as the internet may actually *reverse* such trends (Moynihan and Smith, 2002:859-60). Others commentators, notably Illich (1995; 2001), lay the blame firmly at the door of biomedicine itself, accusing it of facilitating a combination of clinical, social and cultural iatrogenesis. What is clear however is that not only are health identities an emergent and increasingly multiple phenomenon (Fox and Ward, 2006:477) but also that health care spending and *perceptions* of wellness are inversely related (Sen, 2002:859-60). Hauerwas (1993: 49) has further argued that this relentless pursuit of absolute health has led to a loss of the ability to develop communities that can absorb suffering and sustain the sufferer.

Given that concepts of health and illness have no universally agreed and fixed objective meaning, it is unsurprising that many alternative models of health and illness co-exist, even if they are rarely explicitly discussed and defined (Wade and Halligan, 2004:1398). Contemporary Western medicine is still currently dominated by the biomedical model, centred on a mechanistic view of body functioning and shaped by the fear of biological death (Illich, 1995:74; Wilson, 1975:71-2). There is growing recognition however, particularly in light of the emergence of 'new' illnesses such as chronic fatigue syndrome and PTSD, of the role played by psychological, social, and cultural factors (Morris 1998: 71-74) and thus the development of new nosologies that accommodate this. Of these, the biopsychosocial model first proposed by Engel (1977:129-36) has become the most prominent and the main challenger to the biomechanical perspective.

3.2.2 The biomedical model

In his magisterial account of the medical history of humanity, Roy Porter argues that Western medicine, arising in a culture preoccupied with the self, has developed a radically distinctive approach to understanding sickness: throughout history, most peoples and cultures have primarily construed life – birth and death, sickness and health – within a context of understanding human beings as related to the wider cosmos. However the West has dispensed with this connectional understanding and contracted its focus to the individual body and embodied personality. Thus whereas traditional healing systems have sought to readjust relations between the sick individual and the wider world (society and cosmos), the Western medical tradition 'explains sickness principally in terms of the body itself – its own cosmos' (Porter, 1999:7).

Biomedicine's roots lie in the rise of the mechanistic view of the body initiated by Descartes in his 1662 treatise *L'Homme*. The subsequent relentless advance of the Newtonian world view validated this understanding and the rise of medical technology has fixed it. Firmly situated within the scientific paradigm, key points in the model's development were Descartes' separation of body and soul, Harvey's initiation of a systems view of the body, and Virchow's view that all disease ultimately results from cellular abnormalities (Porter, 1999). The Flexner report recommendation that medicine should be underpinned by a thorough training in both biology and laboratory science underscores its lineage (Flexner and Pritchett, 1910). Traditionally then, the biomedical model focuses attention on discovering

the pathology rather than on understanding the illness in a wider context. Furthermore the discoveries of the medical profession have assumed the mantle of positive truths rather than being seen as interpretive accounts of the nature of health problems (Aggleton, 1990:59).

Such a model clearly has great intuitive appeal, an obvious relevance for many disease-based illnesses, and a wealth of supporting biological evidence. Health is seen simply as the absence of disease and the essential reductionism of the model gives rise to a number of associated understandings in which illness and its symptoms always arise from an underlying abnormality of body systems (disease) and are uninfluenced by external factors (though these may affect consequences) Moreover the patient is essentially passive – both aetiologically as a victim of circumstance, and therapeutically as a recipient of treatment.

Western medical thinking is thus firmly based on the concepts of scientific rationality – i.e. that to be valid, hypotheses must be testable and verifiable under objective, empirical, and controlled conditions, and that phenomena must be capable of objective measurement and testing if they are to be considered 'real' (Helman, 2007:121). This, in conjunction with the underlying theory of disease, presents obvious difficulties for attempts to tease out the complex interactions which might connect social integration to health via PNI systems. A contention of this thesis is that whilst such effects cannot be conclusively established within the constraints of the scientific and biomedical paradigms, a transversal approach, integrating data from different disciplines may provide a convincing warrant for them, albeit of a rather different kind.

3.2.3 The biopsychosocial model

It was in response to some of the perceived failings arising from biomedicine's reductive atomism that Engel launched his bold critique of it and presented an alternative model. This stressed the necessity of simultaneous attention to the biological, psychological, and sociological dimensions of illness (Engel, 1977:129-36) and has seen increasing usage within various branches of the medical sciences. In contrast to biomedicine, it recognises that psychological and social factors influence not only disease susceptibility and processes, but also the patient's perceptions and actions, and the progress and outcome of the illness. Thus these

factors have an important bearing on both what it means, and how it feels to be ill (Wade and Halligan, 2004:1398).

Engel's model was formulated at a time when science itself was evolving from an exclusively analytical and reductionist position to become more contextual and cross-disciplinary (Borrell-Carrio *et al.*, 2004:576), and was influenced by the advent of systems theory (Engel, 1977:134-5; von Bertanlaffy, 1975). Whilst not denying the important advances which biomedicine had fostered, his criticism of its dualistic and reductionist understandings effectively signalled both a desire for a move away from the machine approach, and that systems theory might be a constructive influence on how health could be understood. Embracing the insights of this theory, Engel postulated that mental and social phenomena depended on, but were not reducible to more basic physical phenomena. He espoused what would now be understood as a complex emergent understanding with respect to the interactions of biological, psychological and social factors, regarding mental and social life as exerting a real influence on biology. Thirty years on from his insight, there is now increasing evidence to suggest that health and ill-health are strongly linked to a variety of structural factors such as social class, gender, ethnicity, and sexuality (Naidoo and Wills, 2008:4). It is the contention of this thesis that the experience and expression of social relationships also has a *direct* effect on health via alterations of PNI function.

The biopsychosocial model in fact has roots that stretch back to Plato's *Phaedrus* and a passage that speaks of the wellbeing of the body, of the soul, and of the whole, in a single context. Plato suggests that compartmentalisation is a false step and instead allows the inference that the nature of the whole involves the entire life situation of the patient, including his relation to the wider cosmos (Gadamer, 1996:39-42). As an approach to understanding health Engel's model has been hugely influential and most other contemporary formulations owe a debt in some way to its insights and suggestions. But although, like biomedicine, the biopsychosocial approach attends to the biological dimensions of illness, its connectional aspect stands in very sharp contrast to Porter's delineation of the Western concept of the body as 'its own cosmos', and points towards the possibility of a very different *Weltenschauung*. However the central elements of these two contrasting models – mechanisation and embodiment – both have implications for the

understanding the connection between relationality and health explored in this thesis.

3.2.4 Mechanised bodies or embodied persons?

It was suggested earlier (p80) that the dominance of biomedicine has led to a cultural iatrogenesis which has eroded the potential of people to deal with their human weaknesses, uniqueness, and vulnerability in a personal and autonomous way. This in turn has led to led to a loss of the ability to develop communities that can absorb suffering and sustain the sufferer. This would seem in some ways to be an inevitable end result of the ultimate 'mechanised body in a machine-world' model with its alienation of the self from its body and its social situatedness. Moreover, this mechanical worldview both transforms the body into a scientific object and reduces it to a collection of separate parts. It is thus 'simply a machine with interchangeable components', and advances in medical technology – supplying both artificial parts and increasingly sophisticated diagnostic and supportive machinery – as well as developments in genetic engineering indicate its seemingly inevitable 'cyborg' trajectory (Marcum, 2003:37-9).

Medical philosopher James Marcum has argued that the mechanisation consequent upon biomedicine has a threefold effect: fragmentation, standardisation, and alienation. In the first the patient's body is broken into isolated component parts; in the second it is compared to a generic, standardised body; and finally it is estranged from the patient's self, from other people, and the patient's lived context (Marcum, 2003:38). Thus ironically the pursuit of health through the eradication of disease may have the paradoxical effect of increasing illness. As will become clear from both the PNI data presented in section 5 and its subsequent development in the following chapters, the first and third of these effects stand in complete antithesis to the functioning of the immune/endocrine system and to the role which relational context and experience plays in regulating this. The themes of objectification, dismantling, and problematisation and the resulting isolation and alienation will also be taken up in the central conversations, particularly in conjunction with Marcellian contributions to these.

Against this mechanical understanding, Marcum sets an alternative rooted in the phenomenology of Husserl, Heidegger, and Merleau-Ponty and their reaction against what they saw as scientific abstraction and its attendant problems. Here,

rather than being reduced to their component elements, or considering in terms of standardised universals, the person is seen as creating a unique life-world (or being-in-the-world). This is not the physical universe depicted and defined by scientific understanding, but is the world made up of personal activities and relationships. Moreover the body is not something merely possessed as an object but is a lived and integrated unity. Hence illness, rather than being conceived as the mechanical dysfunction of a body part, is understood as a disruption of the life-world. Whilst this is obviously not completely congruent with the biopsychosocial approach there are clearly strong resonances and the two appear to be positioned within a very similar *Weltenschauung.* As will become apparent in subsequent sections, they both also have strong connecting threads, not only with the themes which run through both Old and New Testaments dealing with relational connection and health, but also with the pictures presented by epidemiological and PNI data.

Such data offer strong support for the belief that elements of lived experience do indeed exert real effects on biology. They thus point to the necessity of a more expansive construct than the merely mechanical within which to site the concept of health. The contention developed in this thesis is not simply that social connectivity is one such element, but that the way relational capacity is expressed and experienced can exert effects not merely indirectly – via 'external' mechanisms which reduce perceived stress (such as increased support or better access to information and resources), but also directly – by *itself* moderating biological pathways in immune and endocrine systems. In effect to argue that, apropos of this feature at least, distortion of the life-world and disruption of the mechanics are intimately and inextricably entwined. The difficulties involved in establishing such a connectional chain directly and simply from the observational and experimental data themselves will be discussed at the close of the chapter, along with the proposal that a transversal dialogue between PNI, cognitive neuroscience and theology presents a novel but viable alternative way of approaching the issue.

The first stage in this process though lies in establishing the warrants for the basic contention that relationality and health are connected. It is to this which the chapter now turns, beginning with an outline of some key Biblical understandings of the role which social connection plays in the healthiness of both individuals and

the societies in which they are situated. In keeping with the approach laid out in the previous chapter, these are not offered as items of propositional faith from a specific confessional standpoint, but as rational articulations explored, developed and expressed over long periods of history within two particular frameworks of religious thought. Thus for example vignettes from the life of Christ are not presented as items which are indicative on the basis of a claim to literal factual truth of an incident. The interest is rather on what has been selected as important enough to be preserved and passed on in the oral tradition, and then enshrined in the written record, and in what this then reveals about the underlying understandings of relational connection and health which have been developed within this framework of experiential reference.

3.3 Biblical perspectives linking relationality and health

Although the word 'health' appears only about fifteen times in the entire Bible, it could be argued that the findings of the epidemiological and PNI data presented later in the chapter are strongly foreshadowed in the Testamental canon: woven throughout the texts are themes and motifs which not only indicate that social connection is a central element of existence, but which also link it intimately and inextricably with human wellbeing and flourishing. Indeed relational connection - and the consequences of its disruption - lies at the heart of both Old and New Testaments.

In the former, relation is not only a cornerstone of the key themes of covenant and community, but is also implicit in Hebrew anthropological understanding itself. Thus for example the term *nepheš,* though usually translated as 'soul', implies something very different from the typical Western understanding of such a term. Always occurring in a relational or social context, it is better understood not as an isolated component of a dualistic entity, but rather as a person-in-relation, with the person isolated from their community regarded as sick in their soul (Bruckner, 2005:10-11; Ladd and Hagner, 1996:501). In this respect, it is instructive to realise that the Old Testament concept of *sheol* (the abode of the dead) was one of a ' "thinned down", reduced, isolated life' – essentially, a world in which there was no possibility of relation (Thiselton, 2005:77). The New Testament too turns on a similar axis: from its great theological themes of disrupted,

restored, and transfigured relationships, through their vivid instantiation in the life and actions of Christ, to the 'communism of love' (Troeltsch, 1912/1992:62) displayed by the early church, the whole text is richly redolent with stories and motifs suggesting the absolute centrality of good relationships.

Moreover the close links between *how* such relationality is expressed and the health and wellbeing of individuals and societies are also strong themes across the canon, both overtly and as significant subtexts. In the Old Testament this is established and explicated chiefly through the concept of *shālôm.* In the New it is given explicit expression in the life of Christ through both the healing miracles themselves and in his constant attention to the preservation and development of relational connections. It is these aspects that will be the primary focus for consideration here. As is the case with each of the disciplinary strands contributing to this chapter, the range and depth of the issues precludes anything other than a general overview at this stage, and the biblical verses cited are indicative rather than exhaustive. However specific elements of these themes will be taken up and developed much more fully from a theological perspective as part of the transversal dialogues through which the argument of the thesis will be constructed.

3.3.1 The concept of *shālôm*

Shālôm, an 'iridescent word with many levels of meaning' (Swartley, 2006:27), is derived from a primitive root denoting wholeness or completeness. However the usual translation of 'peace' does not do adequate justice to the richness of the Hebrew concept, which ranges over a number of spheres of action and comprehends many dimensions of physical and emotional experience: for example in 2 Sam 11:7 David inquires of Uriah about the *shālôm* of an individual (Joab), a community (the people), and a larger political sphere (the war). The term and its cognates are very common and usage is distributed across almost all of the Old Testament books (Westermann, 1972:20). As one of the names by which God chooses to disclose himself (Jud 6:23-4), it is strongly associated with God as its source (Is 52:7; 60:17) and with his righteousness, love and faithfulness (Is 32:17; Ps 85:7-13).

With roots in the Yahwistic sense of community arising from Hebrew experiences of slavery and delivery, the early understandings of *shālôm* were linked to the concept of a realm defended against the intrusion of chaos and where life could

be fostered free from fear of all that would diminish and destroy it. It was thus seen as

> a condition of life received by those allowing themselves to be drawn into a pattern of community by the God who delivered Hebrew slaves from bondage (Hanson, 1984:347).

From these beginnings, a rich concept evolved which extended to reach out to a wider community beyond Israel's borders, and to encompass many dimensions of life: wholeness, healing and well-being (Ps 38:3; Jer 8:15; 14:19; 33:6-9, Ps 119:165); justice (Zech 8:19), salvation and the eschatological hope of peace (Is 9:2-7), and material prosperity (Ps 37:11, 147:14) amongst others. In effect the term came to comprehend

> Everything necessary to healthful living: Good health, a sense of well-being, the cohesiveness of the community, relationship to relatives and their state of being, and anything else deemed necessary for everything to be in order (Westermann, 1992:25).

There was thus a strong sense in which *shālôm* was seen as a divine gift, something which was built into a universe from which God had driven back chaos, and which flowed from the covenantal moral attributes of *mišpāt*, *sĕdāqāh,* and *hesed*.[6] But simultaneously, there was also a clear understanding that it was not, first and foremost, a private, inner state but rather one which found external expression in the context of communal life (von Rad, 1985:208). As such it had to be actualised through the way people *chose* to live – the manner in which they expressed their relational connections with one another. Its active pursuit (Ps 34:14) thus took on a moral dimension, since it involved standing against all that violated the divine order for life. Hence there was understood as being a close link between the shape of relational connections and the health (broadly construed) of individuals, nation, and even the wider cosmos.

However this also meant that that the health of people and nation was not guaranteed: breakdowns in relational connections led to disruptions, distortion and complete disappearance of *shālôm,* as seen for example in the descent of post-exilic Israel into bitter community strife dominated by exclusivist views. Here the resulting total loss of shalomic social harmony, and thus of health and well-being, was also accompanied by the displacement of *shālôm* from being understood as

[6] Justice, righteousness, and faithfulness.

an active earthly vocation (Is 2:4; Mic 4:3), to being seen, distortedly, as a future event in which God would inflict defeat on those 'outside' whilst simultaneously blessing Israel (Hanson, 1984:361).

The importance of the moral imperative to pursue *shālôm,* the ease with which it could become subverted and the resultant consequences are also clearly demonstrated in assorted conflicts between the false and true prophets: here the former were loudly proclaiming the existence of *shālôm* whilst in reality injustice was rife (Mic:3:5ff; Jer 6:14; 8:11; Ez 13:16). That they were thus construing *shālôm* in a way which directly contravened it was not only an offence against God, but also intensely damaging to the health of people and nation. In this respect it is interesting to note that despite a tendency to assume that in very unequal societies, the negative social and health consequences are only carried by the least well off, this is not in fact the case: there is increasing and convincing evidence that the increased rates of mental and physical illness and social problems seen in such societies are distributed across the *whole* population – rich and poor alike suffer in their health when social connection becomes distorted (Wilkinson and Pickett, 2009). One could also understand Haurewas' observations about the pursuit of individual health and its wider effects on community ability to support and sustain others (Haurewas, 1993:49) as another example of how the subversion of *shālôm* by an individualism inimical to its essential nature has potentially disastrous consequences for individual and communal health.

These biblical understandings are born out, taken up and amplified in the wealth of the rabbinic texts. In these *shālôm* is again held as a normative ethical category and denotes the overcoming of strife, quarrels, and social tension, and the prevention of enmity and war. Its pursuit is at once both an individual obligation and the goal of various social structures and rules. Thus many passages and sayings which treat on the subject are orientated towards its promotion and preservation in family and communal life, although others are directed more externally to address affairs between Israel and its neighbours (Ravitzky, 2009:686). Moreover it is also, in some senses regarded as a meta-value – one which represents the summation of all other values with the possible exception of *mišpāt* although even this it might temper in some instances (ibid:687).

However rabbinic treatments of the theme, especially from mediaeval times onwards, evidence a more cosmic dimension to *shālôm* in which it is also seen as constituting a distinct ontological principle in the universe. Here, whilst retaining the classical denotations pertaining to human social and political dimensions, it is simultaneously elevated to the level of the metaphysical as a 'cosmic principle' – the ultimate and supreme divine attribute (Ravitzky, 2009:688). Thus *shālôm* also comes to be understood not only as the foundation for all being, but also a condition for the existence and preservation of reality.

Here then we have a concept which not only links social relationships closely to individual, communal, and national health, but which is also seen as being, in some way both reflective of, and fundamentally connected with, elements of the basic order of the universe. These are points which will be considered further in the transversal discussions of Chapters 4-6. There are also strong parallels with insights and understandings which emerge from both the epidemiological and PNI data presented in sections 4 and 5**.**

3.3.2 Relationality and health in the New Testament

Once again there is little direct discussion, and certainly no explicit definition, of health in the New Testament texts. However attention to, and transformation of, relational states play a key role in many of the healing narratives, as well as other events in the life of Jesus which touch on the issue of wellbeing as construed in a larger sense than simply physical health. In fact Jesus serves as a prime exemplar of the relationally-connected person and is repeatedly seen giving himself to others: 'If we see Him alone, we do not see Him at all […] we see Him as theirs, determined by them and for them, belonging to each and everyone of them' (Barth, 1958a:216). If, as Swinton (2000:46) suggests, the act of caring reveals the nature of one's being, then one might reasonably adduce from Jesus' actions something of the central role of relationality ascribed to the character and purposes of God. Once again this is an issue which will be taken up and developed in the first of the transversal dialogues, which considers relationality from an ontological perspective.

Jesus is also seen as coming to usher in the Kingdom of God and his choice of manifesto (Lk 4:16-21) with which to announce this is an interesting one for any consideration of the link between social connection and health. The quoted text is

ostensibly Is 61:1-2, but Jesus omits one of the lines and instead substitutes another taken from elsewhere in Trito-Isaiah: the words in question 'to let the oppressed go free' are imported from Is 58:6, where they form part of a much longer prophetic complaint about Israel's close attention to religious ritual whilst simultaneously ignoring the duties of hospitality and social justice – in effect neglecting the moral imperatives of *shālôm* and thus jeopardising the health of both individuals and nation. Jesus' incorporation of such a text not only announces an intent to fulfil the program of social justice he sees as required by God (Byrne, 2000:49), but also underlines the centrality of *shālôm,* with its relational obligations and their associated health-related effects, in the divine order.

The New Testament texts also make clear not only Jesus' concern to repair disrupted relationality with individuals, but the consequences of this in the wider relational network: for example in Lk 19:1-9, it is not just Jesus' own actions in accosting and claiming hospitality from Zacchaeus that establish relational connection to him; his declaration that "This man too is a son of Abraham" restores and publicly reinforces the latter's proper place within God's people, effectively also reminding the listeners of the obligations of the *shālômic* community. As Zacchaeus in turn begins to mend his own disrupted relational network, both through making redress for wrongdoing, and also by actively overturning a far more fundamental imbalance of resources, health is restored not just to him but also to the wider community in which he is embedded.

However Jesus is not only seen to acknowledge and respond to the importance of good social connection in repairing and fostering well-being, he is also depicted as not averse to pointing out to others where they have failed in this respect, and highlighting the potential consequences for them. Thus in the Lucan vignette presented in 7:36-48 Simon, who had actively solicited Jesus' company at his house and would almost certainly have given him a *shālômic* greeting (1 Sam 25:6) on his arrival, had clearly failed to instantiate the obligations of the implied relational connection. Jesus' actions in accepting anointing from a 'sinful' woman and his accompanying words to Simon not only point out to him the poverty of his relational state, but also hint at its larger implications. In this instance, the comfort and well-being of Jesus is fostered not by the person proclaiming *shālôm,* but through the relational connection offered (at personal cost) by an excluded

woman; and she in turn, as Jesus makes clear, recovers *shālôm* through her expression of that relationality.

Jesus then is always shown as keen to acknowledge the central place of relational claim and connection in everyday human life – and in this respect it is significant that his first action in dealing with the Gaderene demoniac in Lk 8:26-38, is to ask "what is your name?": even the forces of chaos which threaten divine order can be dealt with in the context of relational connection. His words also often underline the idea that the maintenance of proper relationality requires active participation; and his actions demonstrate a readiness to do whatever is necessary in this respect to ensure its healthy functioning. An archetypal example here is that given by the author of Matthew in 8:1-4 in which Jesus' declaration "I am willing" is immediately followed by the establishment of a physical contact with the leper who has accosted him. The story of the ten lepers in Luke 17:15-19 [is] also illuminating on the subject of the importance of active relational participation to health in its fullest, *shālômic* sense: here, although all the lepers are physically healed, only one returns to acknowledge and celebrate the connection which has been the instrument of healing; only one reaches out to establish, through praise, a relational link with God; and only one is recognised by Jesus as being 'well'.

This care which Jesus is shown as demonstrating for both the repair and preservation of relationality, and its connection to wellbeing, is perhaps most clearly and poignantly illustrated by its prominent place in both the Lucan and Johanine accounts of episodes occurring in the final hours of his life. In the former (Lk 23:40-3) the dying thief gropes towards a final experience of social connection which Jesus, despite his own suffering, recognises and responds to: through both the fact of his answering and the content of his response, he is shown as not only indicating his willing acceptance of the bond but also confirming both its ongoing trajectory and its healing nature. In the Johanine account (Jn 19:25-7), Jesus is recorded as demonstrating a similar attention to the relational needs of his mother: here, through words directed towards her and a particular disciple, he takes steps to affirm the importance of these needs and to make future provision for them to be met when he can no longer do so himself.

This strong impetus towards relational restoration is also a consistent feature of the accounts of Jesus' healing miracles. In these there is almost invariably a sub-

text of alienation and disrupted relationships, and the restoration of health is as much to do with the repair of these as with any physical healing involved. There are many such instances but Luke 8:42b-8 serves well as a paradigmatic example here: the woman in question suffers a sickness that is both physically and socially devastating since it renders her ritually unclean. Like the demoniac of Luke 8, who was reduced to inhabiting the tombs of the dead, she exists outside the boundaries of the living community. There is thus a severe curtailment of normal relational possibility – indeed she is as good as dead in the communal sense (Byrne, 2000:83) – and it is this, as much as the bleeding, which destroys her health. As with so many of the healing stories, the sequence is initiated by an appeal to relationality, although in this case, it is not vocal. But whilst the woman's touching of Jesus apparently effects an immediate physical result, Luke underlines that he is not content to leave her cured only in the biomedical sense. The account of his subsequent search for and identification of her, coupled with the public affirmation of kinship which his appellation of "daughter" confers, proclaims, and confirms her right to relational connection, and restores her to both *shālôm* and to the larger community from which her bleeding has excluded her.

Thus in its treatment of events in the life and ministry of Jesus, the New Testament confirms and amplifies the apprehension running through the Old that social connection and health are inextricably linked. In both instances, strong and healthy social relationships are seen as not only essential to personal health and well-being, but also as having significant ramifications for the health of others in the connectional network, and for the society within which this is situated. The importance of maintaining and developing this relational connection is such that its pursuit takes on the nature of a moral imperative, and its neglect is seen as threatening the divine order. As has already been suggested, there are many elements in this biblical perspective which anticipate and resonate with the conclusions increasingly being drawn from the studies undertaken by social epidemiologists which form the next arena of exploration.

3.4 Epidemiological perspectives on sociality and health

3.4.1 Review of studies

Epidemiology's roots extend back to observations made by Hippocrates, but its formal disciplinary beginnings lie much closer in the 19th century. Similarly, despite the previously noted longstanding recognition that social conditions influence health, the rise of social epidemiology – the study of the relations between social factors and disease in populations (Kauffman, 2008:532) – is a much more recent enterprise, albeit one already yielding important information (Berkman and Kawachi, 2000:10). A wide range of variables have been investigated but those of interest here relate to social networks and their connection with morbidity and mortality rates.

The suggestion that social environments might have effects on health was first raised more than thirty years ago in seminal papers by Cassel (1976:107-23) and Cobb (1976:300-14), with a subsequent explosion of studies addressing the issue. One perennial difficulty, particularly with early studies, is the variability of the definition and measurement of terms and concepts such as social 'support', 'ties', 'bonds', and 'networks'. Thus although the predictive power of such measures often appeared indisputable, the interpretation of what was actually being measured was much more debatable (Berkman and Glass, 2000:142). However work on more rigorous definitions of critical dimensions of support (e.g. House, 1981) and the development of new models for categorising support (Thoits, 2011:145-61) have attempted to address these issues and provide clearer conceptions of these features and their interconnections. Such difficulties notwithstanding, there has been a steadily accumulating wealth of epidemiological evidence supporting the idea that the degree to which an individual is embedded in, and interconnected with, a community has important implications for their health and wellbeing.

Multiple studies appearing in the 70s and 80s, usually measuring numbers of close relatives/friends, marital status, and membership of religious or other social organisations, consistently linked impoverished social connection with increased mortality from almost all major disease groups (for meta reviews see Berkman, 1995:245-54; Cohen, 1988:269-97; House *et al.*, 1988:540-5). The significance of this wave of studies lay in the nature of the studies themselves: earlier epidemiol-

ogical work had been almost entirely retrospective (taking data from hospital records and death certificates) and cross sectional, and thus not only was control for confounding variables at best partial, but the studies were unable to determine whether poor social relationships preceded or post-dated ill health. In contrast, these new studies were, by and large, long term prospective studies of community populations. They therefore offered significant advantages, not only by providing large sample sizes with low drop-out rates and reducing confounding biases but also, because the markers of social connection were measured at the outcome, making it possible to assess the predictive value of such variables. Classic large scale population studies such as those from Alameda (Berkman and Syme, 1979:186-204), Tecumsah (House *et al.*, 1982:123-40), and Durham (Blazer, 1982:684-94) counties, Finland (Kaplan *et al.*, 1988:370-80), and Sweden (Orth-Gomér and Johnson, 1987:949-57) all reported significant correlation between poor social connectivity and all-cause mortality.

In a seminal paper, House collated and reviewed these and other studies, setting the results alongside experimental human and animal data from psychosocial research, and new theoretical models arising from these. The conjunction of these different data and perspectives led him to conclude that a relative lack of social connection constituted a significant risk factor for health comparable to that of well-established factors such as hypertension, obesity, and smoking (House *et al.*, 1988:540). Furthermore, since controlling the psychological studies for personality variables, and the epidemiological studies for biological and health variables, had both failed to explain away the predictive association between social isolation and mortality, then there were reasonable grounds to conclude that social relationships had a predictive, and arguably causal, relationship with health *in their own right* (House *et al.*, 1988:545). Further studies have followed and there is now a substantial volume of literature exploring and establishing this link and investigating a wide range of outcomes. It is not possible here to provide anything other than a brief indication of representative studies connected with two significant causes of mortality – cardiovascular and malignancy. However comprehensive reviews covering a whole array of outcomes exist in the literature (see for example Anderson D, 1996:739-44; Berkman, 1995:245-54; Ell, 1996:173-83; Olsen, 1993:176-80; Seeman, 1996:442-51; Thoits, 1995:53-79).

As already indicated there have now been a number of large prospective cohort studies in the USA (see above), the UK (Stansfeld *et al.*, 1998a:247-55; Stansfeld *et al.*, 1998b:881-92), Scandinavia (Welin *et al.*, 1985:915-8), the Netherlands (Penninx *et al.*, 1997:510-9), and Japan (Sugisawa *et al.*, 1994:S3-S13) showing that those who are socially isolated (as variously measured) are more at risk of dying prematurely from all causes of mortality. For example the Alameda county study cited above revealed a 2-3 times greater risk of death in a nine year follow-up period for those with fewer social connections; it also established that this relative risk was not simply centred on a single pathology such as cancer or ischaemic heart disease but related to all causes of mortality. Moreover the relative risk of social isolation was independent of both assorted health behaviours and co-morbid conditions present at the baseline recording. Several studies on older populations have confirmed that the protective effect of social connection persists into later life (Seeman *et al.*, 1993:325-35; Seeman *et al.*, 1987:714-23).

With respect to cardiovascular causes of morbidity and mortality, no evidence of influence, either protective or otherwise, has so far been convincingly demonstrated on the actual onset of cardiovascular disease (Berkman and Glass, 2000:162); although there is some evidence of a reduced incidence of cerebrovascular accidents in those with strong social networks (Kawachi *et al.*, 1996:245-51). However a variety of studies suggest that the strength of social ties significantly influences outcomes with respect to *recovery* from both myocardial infarction and cerebrovascular accidents, (Berkman *et al.*, 1992:1003-9; Orth-Gomér *et al.*, 1988:205-15; Ruberman *et al.*, 1984:552-9; Williams *et al.*, 1992:520-4), with stronger connectivity being associated with improved outcomes. Conversely, impoverished social networks have been shown to be significantly correlated with premature mortality from vascular disease in middle-aged men (Olsen, 1993:176-80). In the case of cerebrovascular accidents, those who are socially isolated have a greater risk of death (Kawachi *et al.*, 1996:245-51; Vogt *et al.*, 1992:659-66) particularly in the presence of concomitant depression (Morris *et al.*, 1993:124-9). In contrast, good social connection has been associated with improved recovery both functionally and psychologically (Evans *et al.*, 1987:508-12; Friedland J and McColl, 1987:475-80; Glass *et al.*, 1993:64-70) and shown to be an important predictor of hospital course (Colantonio *et al.*, 1993:S261-8).

In respect to malignancy, a 17 year prospective study of the Alameda cohorts showed that while social connections were not predictively associated with cancer incidence or mortality in men, those with fewer connections had significantly reduced survival times. Socially isolated women were found to have a significantly elevated risk of dying from cancer of all sites (Reynolds and Kaplan, 1990:101-110). Other studies have suggested that degree of social involvement plays a role in survival from breast cancer and other cancers (Ell *et al.*, 1992:531-41; Funch and Marshall, 1983:77-83; Waxler-Morrison *et al.*, 1991:177-83); and a recent meta-analysis of 87 studies confirmed a decrease in relative risk for mortality in those with high levels of perceived support and larger social networks, especially in younger patients (Pinquart and Duberstein, 2010:122-37).

3.4.2 From connection to causality

Even from such a limited presentation of the available data, it is clear that a strong predictive link exists between social connection and assorted health outcomes: House's original assessment on this point has been born out by multiple studies of different types, involving analysis of different variables and different populations and drawing on increasingly sophisticated theories, models, and analytical tools. However as his comment makes clear, this does not automatically imply that the connection is *necessarily* a causal one: in disease patterns, things are rarely as simple as a one-to-one correspondence between observed cause and effect, and while epidemiological studies may permit inferences of causality, they cannot *prove* its existence.

In part this is because of the nature of the studies themselves and unintentional selection bias, unrecognised or poorly controlled confounding variables, and chance occurrences can all distort observed linkages. It also reflects the complex nature of causality in disease: factors may be operative in a variety of different 'causal' ways – as predisposing, precipitating, enabling/disabling, or as reinforcing. Moreover there are often multiple causes at work with a hierarchy of proximal (precipitating) and distal (enabling) factors. Indeed the very concept of cause is the source of much controversy in epidemiology (Bonita *et al.*, 2006:83). Various guidelines such as plausibility and consistency exist for assessing the likelihood of a linkage being causal but of these, only correct temporal relationship is a *sine qua non.*

Causal inferences in epidemiological studies thus require extremely skilful judgements in a whole variety of directions and leave much room for legitimate disagreement. Hence epidemiological inferences about causal hypotheses are intentionally sceptical. Moreover even after tentative conclusions are reached, alternative explanations and theories will continue to be raised and considered (Gerstman, 2003:290). Occasionally aetiological hypotheses attain an extremely high degree of certainty which is almost universally accepted (for example the connection between cigarette smoking and lung cancer). These are as close as epidemiology comes to proof (Rothman *et al.*, 2008:24) – indeed just as with empirical science, there simply is no such thing as 'ultimate proof' in epidemiology (Gerstman, 2003:289). Nevertheless, more than a quarter of a century after House's original observation, a generation of empirical research seems to strongly validate not only the assessment of the predictive value of social relationships for mortality, but also the suggestion that they exert an independent influence on this (Holt-Lunstad *et al.*, 2010:12), and the weight of the accumulated epidemiological evidence is taken by many to provide sufficient warrant for the attribution of some kind of causal link. What these studies cannot do however is provide any evidence as to the mechanisms by which this might be mediated, although various pathways seem to offer possibilities (Uchino *et al.*, 2012:221).

Social networks provide opportunities for a variety of psychosocial mechanisms through which health can, by a complex array of paths, be influenced. Thus for example they can offer various and very different types of support and influence; they present a range of possibilities for contact and different types of social engagement; and they can be the means of accessing assorted resources, information, and material goods. Any of these may in their turn affect health outcomes via modification (positive or negative) of three key pathways: i) health-related behavioural ones such as diet, exercise, drug and alcohol consumption, sexual habits etc. ii) psychological mechanisms, for example self-esteem, coping strategies etc. and iii) through physiological pathways such as the transmission of infectious disease, or alterations of immune and endocrine function and of allostatic load.

It is this final route which is the focus of the current project – specifically alterations of immune and endocrine systems in response to allostatic[7] demands. The possibility the project seeks to explore is that something about *the nature of social relationship itself* can affect these systems directly – in other words that it has an internal effect, directly integrated into immune and endocrine regulation. The final tranche of data to be presented thus looks at PNI studies exploring the effects of different aspects of relational connection on endocrine and immune function.

3.5 PNI Perspectives

3.5.1 Immunological Prolegomena

The modern early view of the immune system was of a closed and functionally autonomous system. However Ader's elegant demonstration that immune responses could be influenced in precisely the manner associated with classic central nervous system (CNS) conditioning (Ader and Cohen, 1975:333-40) decisively overturned this view. Now, what were previously seen as completely separate systems are increasingly understood as components of a single, integrated 'defence mechanism' in which interactions *between* the systems are as vital as those *within* the individual systems themselves:

> The immune system is highly integrated with other physiological systems. It is sensitive to virtually every hormone, and sympathetic, parasympathetic, and sensory nerves innervate the organs of the immune system. In turn, the nervous, endocrine, and immune systems communicate bi-directionally through common hormones, neuro-peptides, and cytokines. […] behavioural responses are key in the activation of neuroendocrine and autonomic pathways, which in turn modulate the immune system with implications for increasing susceptibility to a variety of diseases. […] communication between the brain and the immune system is reciprocal (Irwin, 2008:137).

Psychoneuroimmunology is the relatively young but substantial and rapidly expanding discipline which studies these relationships between behavioural, neural, endocrine, and immune processes (Kiecolt-Glaser *et al.*, 2002c:16). Its growing corpus of experimental data increasingly confirms the apprehension, held since antiquity, that the emotional, spiritual, psychological, and physical dimensions of

[7] The maintenance of homeostasis in the face of change (McEwen and Wingfield, 2003:3). See further at p220ff.

life are intimately linked with health. Immune function and its operational interaction with the endocrine system are both complex and multileveled phenomena, thus a brief outline of some key points is necessary as a basis for understanding the following data and subsequent thesis arguments (Daruna, 2004:23-55, has a comprehensive and accessible introduction to system elements). In particular, I want to highlight the role of cytokines (signalling molecules) since this will play an important part in the final thesis argument.

It is now well established that the immune system is hardwired to the central nervous system, that communication between the two is bi-directional, and that each exerts a variety of influences on the other (Ader and Kelley, 2007:2). Both systems monitor the internal and external environments, evaluating possible threats and initiating appropriate response mechanisms in response to pathogenic invasion or other challenges to system integrities. Detection of a perceived stressor leads to neuronal activation in specific brain loci; this in turn excites the release of hormones from various endocrine glands or nerve terminals. These hormones then interact with specific receptor cells within the immune system and the ensuing cascade of events moderates immune function at the cellular level via the action of leucocytes (white blood cells) and cytokines. The latter are a diverse group of small proteins which act as the basic signalling molecules of the system, mediating specific physiological responses via alterations in neuroendocrine and neurochemical processes, and by up or down-regulating specific genes or their transcription factors to facilitate the production and proliferation of specific immune cell subsets in response to infection or other tissue insult. Cytokines exhibit both pleiotopy[8] and redundancy[9] and their regulatory system is one of huge complexity employing feedback loops whereby they can inhibit or stimulate their own release or that of other cytokines depending on the tissue and the specific situation (Banks, 2005:973). They are active in both the peripheral tissues and the CNS itself. In the latter case they originate directly from neurons, astrocytes, and microglia, in response to stimuli external to the CNS. Such stimuli are transmitted either via afferent nerves – principally the vagus (Jain *et al.*, 2012:323) – or by other, blood-borne, cytokines which can cross the blood-brain barrier and affect brain tissue directly via interaction with intrinsic brain cytokine

[8] i.e. any one cytokine may have several different actions.
[9] i.e. several different cytokines may have the same action.

systems (Banks, 2005:973-84). There is also increasing evidence that these play an important role in aspects of neuroplasticity (see Bauer *et al.*, 2007:221-32, for a review).

Cytokines can be broadly divided into two groups: those which promote inflammatory processes and those which inhibit them. The former are essential in the early phases of response to invading pathogens and to other threats at both tissue and central level. At the former they act in a variety of ways to facilitate immune response – for example by increasing vascular permeability to allow the ingress of cells to damaged tissue, stimulating the differentiation and release of certain immune-cell subsets etc. Within the CNS, they influence neurotransmitter metabolism, neuroendocrine function, synaptic plasticity, and the neurocircuits regulating mood, motor activity, motivation, anxiety, and alarm (Capuron and Miller, 2011:226-38). This leads to the classic symptom constellation of 'sickness behaviour': loss of appetite, fever, aching joints, fatigue, withdrawal etc. (Dantzer and Kelley, 2007:153-60; Dantzer *et al.*, 2008:46-56). Anti-inflammatory cytokines are important in the subsequent management of the amplitude and duration of the inflammatory response – something which is essential to prevent unnecessary tissue damage. The balance between these two aspects of cytokine activity is critical: acute responses to pathogens and other stressors are a vital part of allostatic responsiveness, but pro-inflammatory cytokines and chronic inflammatory states are increasingly being implicated in the pathogenesis of major causes of mortality such as cardiovascular disease (Hansson, 2005:1685-96) and cancer (Hong *et al.*, 2007:1911-28), as well as in depression (Miller *et al.*, 2009:732-41) and neurodegenerative conditions (Hayley and Anisman, 2005:947-62). There are also indications that they may be involved in conditions such as bipolar disorder (Brietzke and Kapczinski, 2008), autistic spectrum disorder (Li *et al.*, 2009:111-6), and in depression-related suicide (Kim *et al.*, 2008). Both good immune responses *and* their subsequent regulation are thus key integrative aspects of good health, and maladaptive alterations have the potential to influence the aetiology, severity, and progression of a spectrum of diseases (Kiecolt-Glaser *et al.*, 2002b:543). In Chapter 6, I will suggest that altered cytokine responsiveness and subsequent shifts in the balance of allostatic load are a possible mechanism linking relational connection directly with pathological processes and thus health outcomes.

Turning to PNI studies themselves, these are not only complex, but are also fraught with methodological difficulties (Robinson *et al.*, 2002:165-175). It is thus vital for any argument attempting to build on such data to be aware of their limitations. Firstly, it must be noted that the vast majority of the studies are, like the epidemiological studies, correlational in nature. Thus although they may raise evidence of a relationship between variables studied, statements about direct causality drawn from the studies themselves are inadmissible. Secondly, a large number of factors are known to be immunomodulating – for example age, sex, exercise, tobacco and other recreational drugs have all been demonstrated to affect immune function (Hoffman-Goetz and Pedersen, 1994; Kiecolt-Glaser and Glaser, 1988). Hence successful control for all confounding variables is difficult and many studies only achieve limited controlling.

Further difficulties arising from the laboratory aspect of the studies relate to the standardisation of collection and measurement procedures (Uchino *et al.*, 1996:519); and to the degree to which the measured immune system variables actually reflect the true level of immunocompetence (Schulz and Schulz, 1992). Since the only component of the immune system easily studied is the blood, most *in vitro* assays from human studies are done on peripheral blood samples. Thus they do not necessarily reflect what is actually happening in the lymphoid organs (Kiecolt-Glaser *et al*., 2002c:21). Data also need to be analysed with a clear understanding of their functional and clinical implications, particularly since statistical and clinical significance may not necessarily equate. For example if measured levels of immunoglobulin G in an individual are 2 standard deviations below the mean, this would be deemed a statistically significant variation; however such a level would still be comfortably above that required to protect from bacterial infection and thus clinically this would not constitute a significant result (Robinson *et al*., 2002).

From the non-laboratory side, a key issue for the studies of interest here relates to how the social variables under examination are operationalised. As with the epidemiological studies, there is a marked heterogeneity of approach across studies as to how 'social support' is understood and measured. Furthermore there is a tendency to treat it as a one-dimensional construct (Uchino *et al.*, 1996:522). However social support, broadly speaking, incorporates two distinct but intercon-

nected elements – one structural and one functional. The former relates to the extent of and degree to which an individual is integrated into social networks (family, friends, colleagues, interest groups etc.) Measurement of these social ties can take the form of number of network members, the type of relationship, and the amount of contact (Uchino *et al.*, 2012:215), though such aspects are often not analysed in any great detail in PNI studies. The precise contribution of each element is far from clear and a recent meta-analysis indicates a significant variability in the predictive utility of these different variables, with multidimensional assessments of social integration being the optimal predictor of mortality risk (Holt-Lunstad *et al.*, 2010:1-20, 14). The functional element of social support deals with the degree and type of support received, and incorporates emotional, informational, practical, and belonging elements (Uchino *et al.*, 2012:216). Another important potential dividing line is between perceived and actual support since these seem to have significantly different effects (e.g. Reinhardt *et al.*, 2006:117-29) and to correlate differently with mortality rates (Uchino *et al.*, 2004). In contrast to the epidemiological studies which focus mainly on structural support, most PNI studies deal with elements of *perceived functional* support. I will return to these issues when considering the role which the shape of relational connection might play in mediating PNI effects.

Finally problems also arise from the complex and multilayered nature of the systems and processes under investigation, and the difficulties of disaggregating their various elements – the pleiotropy of the cytokine system has already been noted and the issue is further complicated by the fact that some key cytokines implicated in chronic inflammatory states – for example Inter-Leukin 6 (IL-6) – are known to have both pro- and anti-inflammatory functions (Hawkley *et al.*, 2007:83-5). Furthermore, since any study can only supply information about a small portion of the processes which may be involved, definitive determinations of the degree of overall effect on immune functioning are difficult. I will return to these various difficulties in section 6 and suggest that the transversal approach adopted in this study provides a possible way of negotiating them.

3.5.2 PNI studies involving relationality

The epidemiological data presented in the preceding section have established the importance of relational connections in connections with health outcomes: Those with a higher level of social contact (both quantitatively and qualitatively) are

more likely to live longer and maintain better health; those with impoverished relationships carry a significantly increased risk of morbidity and mortality, comparable in terms of statistical effect, to those associated with smoking, obesity and hypertension. One possible pathway through which this effect might be mediated is through alterations of PNI systems and a large and steadily growing number of studies have investigated assorted measures of social connectivity against an array of endocrine and immune markers.

One of the explanations offered for the protective role of social relationships in health terms is that they offer a defence against stress, which is known to be a potent moderator of PNI function. Although the concept of stress was formulated over 60 years ago (Selye, 1956:525-30), it remains ambiguous: 'Everybody knows what stress is and nobody knows what it is' (Selye, 1973:692); this is further compounded by the conflation of both the stressor and the physiological response it evokes under the term. However a critical point to note here is that stress is not synonymous with damage, and the expression of stress responses does not of itself *necessarily* compromise health and/or welfare – indeed short term stress responses are a central part of allostatic adaptation (Korte *et al.*, 2005:4). This is underlined by a recent meta-analysis of 300 studies published over 30 years, dealing with the relationship between psychological stress and immune functioning: while acute stressors (i.e. short-lasting ones) produce adaptive up-regulation of PNI systems, chronic stress depresses both cellular and humoural[10] immunity (Segerstrom and Miller, 2004:601-30). With regard to the latter scenario however, the effect is clearly far from being uniformly benign, and another large scale review of all data published since 1939 concluded there are now sufficient data to establish that this immune down regulation by social stressors also leads to actual health changes (Kiecolt-Glaser *et al.*, 2002c:15-28). Moreover, since age and stress seem to interact in a way which leads to an increased down-regulation of immune systems when the two factors coincide (Kiecolt-Glaser *et al.*, 1997), then stress related alterations in immune function are likely to have increasing health consequences with increasing age. From this perspective it is worth recalling that confirmation provided by Seeman's studies (p94**)** that the protective effect of social connection persists into later life.

[10]i.e. that involving antibody responses.

The strongest experimental evidence for the effects of stress relates to wound healing (Broadbent *et al.*, 2012:212-7; Broadbent *et al.*, 2003:865 - 869 ; Gouin and Kiecolt-Glaser, 2011:81-93; Walburn *et al.*, 2009:253-71) – where the effects are not just statistically significant, but large in a substantive and measurable clinical sense – and to susceptibility to infectious diseases (Cohen, 2005:123-131). However such studies reveal nothing about the actual process behind this effect. There are two possible (but not mutually exclusive) scenarios here: social support, via structural or functional dimensions alone or in combination, moderates the perceived severity of stressors, in other words the modulating effect occurs prior to excitation of PNI responses; alternatively there is something about the *experience of relatedness itself* that directly affects the components or regulation of PNI systems. It is this latter option which this thesis is exploring.

Studies have looked at psychological, endocrine, and immunological components of PNI function in relation to social support networks. A number of large scale reviews deem social support to be reliably related to a variety of beneficial effects on cardiovascular, endocrine and immune systems (Uchino, 2006:377-387; Uchino *et al.*, 1996:488-531; Uchino *et al.*, 1999:145-8), with Kiecolt-Glaser concluding that the link between personal relationships and immune function is 'one of the most robust findings in PNI' (Kiecolt-Glaser *et al.*, 2002a:21). Positive primary relationships also appear to reduce cardiovascular stress responses (Uno *et al.*, 2002:243-62). Effects on both cell-mediated and humoural immunity have also been demonstrated, with good social contacts consistently correlating with up-regulation (Moynihan *et al.*, 2004:950-953) and demonstrating improved responses to vaccination(Glaser *et al.*, 1992:22-9), whereas those with poor contacts consistently demonstrate down-regulation of various immune functions (Pressman *et al.*, 2005:297-306). Similarly, interpersonal relationships can also modulate cardiovascular and endocrine function in a variety of up- or down-regulatory ways (McGuire and Kiecolt-Glaser, 2000:136-9).

Further studies indicate that support can act as a buffer during both acute and chronic stressors to protect against immune dysregulation (Esterling *et al.*, 1990:397-410; Kiecolt-Glaser *et al.*, 1992; Kiecolt-Glaser *et al.*, 1991:345-62; Linn *et al.*, 1988:230-44; Theorell *et al.*, 1995:32-6; Theorell *et al.*, 1990:511-6; Uchino *et al.*, 1996:488-531). The converse also appears to hold, with other studies show-

ing that in the context of naturalistic stressors such as job stress (Theorell *et al.*, 1990), dementia care-giving (Esterling *et al.*, 1994), and surgery (Linn *et al.*, 1988), lower levels of support are associated with poorer immune function. An important point should also be emphasised here, namely that being a *provider* of support, especially in the long term, can be detrimental to immune functioning, leading to down-regulation (Baron *et al.*, 1990:344-52). Studies of spousal care-givers in dementia have found them to show depressed cellular immunity and higher rates of depression and infectious disease; these effects are most marked in those who are chronically stressed and who receive lower levels of support themselves (Kiecolt-Glaser *et al.*, 1991:345-62). These points will be developed further as part of the examination of realised relationality in Chapter 6.

There has also been some work looking at the effects of social support on immune function in cancer sufferers. Here studies looking at gynaecological malignancies have shown a correlation between good social support and lower levels of cytokines implicated in tumour oncogenesis (Costanzo *et al.*, 2005:305-13; Lutgendorf *et al.*, 2002:808-15) and angiogenesis (Lutgendorf *et al.*, 2000:127-42). Further studies by Lutgendorf have also demonstrated an association between good social support and positive changes in cellular immune responses in both peripheral blood and ascitic (i.e. tumour-related) fluid (Lutgendorf *et al.*, 2005:7105-13) as well as in tumours themselves (Antoni and Lutgendorf, 2007:42-6). A study in breast cancer patients showed a similar correlation with enhanced levels of immune components active against malignant cells (Levy *et al.*, 1990:73-85). There is also evidence from a number of studies that well-supported partners or spouses of patients with cancer also have better immune function than those who are less so (Kiecolt-Glaser *et al.*, 1992). Moreover this appears to be a positive correlation in its own right, rather than due primarily to higher levels of depression or stress in the latter group (Baron *et al.*, 1990).

In the studies involving patients with HIV/AIDS, the relationship between social support and changes in immune markers is less clear cut. A significant volume of literature indicates that psychosocial factors influence disease outcomes (see Chida and Vedhara, 2009:434-45; Cole, 2001:583-612, for reviews). However studies of the specific role of social support have produced conflicting results with some studies (e.g. Burgoyne, 2005:111-124; Leserman *et al.*, 2000:1221-8; Leser-

man *et al.*, 2002:1059-73; Persson *et al.*, 2002:184-90; Theorell *et al.*, 1995:32-6) indicating a more favourable disease course in those with good support, whilst others (e.g. Blomkvist *et al.*, 1994:185-92; Patterson *et al.*, 1996:30-9; Persson *et al.*, 1994:580-5) indicated a detrimental effect. This discrepancy may reflect the changing trajectory of disease progression in HIV/AIDS – for example participants in early studies carried a far higher burden of both AIDS-related bereavement and care giving duties. It may also be affected by complex social and identity issues involving the gay community amongst whom most of the studies have been carried out (Sloan and Cole, 2007:1062). Studies which looked specifically at immunological function reveal a similar discrepancy: a number show a correlation between levels of support and CD4+ cell numbers in HIV positive men, particularly the rate of decline in cell numbers over time – an important marker of disease progression (Persson *et al.*, 1994:580-5; Theorell *et al.*, 1995:32-6). Others though have been less successful at establishing a link between social support and immunological disease markers (Goodkin *et al.*, 1992:635-50; Perry *et al.*, 1992:396-401). Additional difficulties here may stem from the nature of the disease process itself however, since not only is the primary locus of disruption within the immune system itself, but also the nature of that disruption is overwhelming.

Another significant group of studies are those looking at PNI function in married couples. Marital/partner relationships are a central source of social support and are powerfully linked to an individual's emotional and psychological functioning (McGuire and Kiecolt-Glaser, 2000:136). Marital discord has been correlated with both poorer wound healing and raised levels of pro-inflammatory cytokines (Kiecolt-Glaser *et al.*, 2005:1377-84). Moreover, disruption of close or partner relationships whether by bereavement (Bartrop *et al.*, 1997:374-77) or divorce (Kiecolt-Glaser *et al.*, 1988:213-29) has shown correlations with a depression of immune functioning as measured by a variety of markers.

Key studies here have been ones looking at aspects of couple interaction: married, recently separated or divorced couples, newly weds, and established couples, have all been studied interacting, particularly under conditions of stress, and various endocrine and immunological markers measured. Such studies have shown that marital or relationship 'quality' (variably operationalised) correlates with a variety of markers. Typical findings are that recently separated couples have sig-

nificantly poorer immune function as indicated by a variety of functional measurements; as do those couples with 'poorer quality' marital relationships. Immunological changes were not always large but were consistent (Kiecolt-Glaser *et al.*, 1987:13-34). Similarly, separated or divorced men had significantly impaired immune responses in a variety of assays when compared with matched controls (Kiecolt-Glaser *et al.*, 1988:213-229). Studies looking at behaviour during conflict resolution tasks have demonstrated both a down-regulation of immune function and an increase in stress hormones in those couples with more abrasive interactions (Kiecolt-Glaser *et al.*, 1993:395-412). This effect is seen in both new (Malarkey *et al.*, 1994:41-51) and established marriages (Kiecolt-Glaser *et al.*, 1997:339-49). In contrast, spousal support and satisfaction appears to positively moderate both hormonal and affective responses to conflict discussion (Heffner *et al.*, 2006:317-25), the effect again demonstrated in both new and long-established marriages. In the latter group, this was particularly marked in the men – possibly indicating a relative impoverishment of their other social networks. Positive and supportive behaviour during the conflict task itself has also been correlated with regulation of the hypothalamic-pituitary-adrenal axis, a key player in immune system excitation (Robles *et al.*, 2006). Finally, and intriguingly, PNI measurements might foreshadow later relational changes: one large study looking at immune variables in response to conflict discussion in ninety couples in the first year of marriage and then after ten years found that initial neuroendocrine function measurements were related to marital dissolution and satisfaction 10 years later (Kiecolt-Glaser *et al.*, 2003a:176-88). These marital studies will be examined in more detail in Chapter 6.

In summary, and despite some of the methodological caveats noted above, there would appear to be sufficient weight of evidence to warrant a claim that aspects of interpersonal relationships appear to modulate endocrine and immune function in a variety of ways resulting in both up- and down-regulation of systems. Over a wide range of studies, close and supportive relationships consistently correlate with lower levels of stress hormones, stronger immune responses (as measured by a variety of parameters), decreased risk of infection, and better wound healing. Conversely, social isolation and negative or acrimonious relationships are consistently associated with raised levels of stress hormones, poorer immune function (as measured by a number of variables) and higher morbidity.

However, there are additional difficulties beyond the practical methodological ones which not only make it difficult to definitively attribute causality but also to determine and delineate the precise nature of any causal pathways and whether they represent direct or indirect effects.

3.6 Bridging the gap: developing a transversal approach

The difficulties inherent in interpreting epidemiological studies, the necessity of exercising skilful judgement in so doing, and the absence of any possibility of definitive proof of a hypothesis have already been noted. Similarly, with the PNI data presented above, experimentally derived suggestions of a connection between the elements under investigation cannot simply be transformed into attributions of causality. In part this is due to the methodological issues outlined in 3.5.1 above**,** but also to the inherent difficulties in studying such a complex system – something which also presents difficulties for determining the *clinical* significance of any laboratory results.

The neuroendocrine system consists of a vast array of components, interconnected in multiple ways. PNI studies usually involve measurements of a specific immune or endocrine component at cellular level and any study can only supply information about a very small portion of the processes which may be involved. Thus definitive determinations of the degree of overall effect on immune functioning are difficult. Moreover, since system events continuously modify events at cellular and higher levels, with consequent effects on other variables in both the system and the external environment, it is likely that results from even the best constructed experiments may differ significantly. These factors, taken in conjunction with the correlational nature of the studies, means that there is a big leap from laboratory data to any clinical inferences about health-related effects. Thus it is impossible to conclude, on the basis of PNI studies alone, that a particular variable such as social support directly affects health outcomes via immune modulation. The epidemiological studies reviewed do however lend additional support to the hypothesis and this opens the possibility of developing a transversal version of the mutually interlocking support described in the previous chapter. However the establishment of causality is only part of the issue here.

Even *were* it possible to confidently assert a causal link, from either the PNI or the epidemiological data or a combination of the two, it is not immediately deducible from these data how this effect is mediated. One likely candidate is the idea that social relationships provide a protective effect by decreasing stress in various ways. In PNI terms this would situate the primary locus of action as thus *prior* to CNS excitation: because of social connection and attendant support, the perceived severity of the stressors is lessened, CNS response is moderated and PNI effects ameliorated accordingly. Thus the immune and endocrine systems are protected from outside the system. However a second possibility is that the functional response of PNI systems to CNS stimulation is being *directly* moderated in some way by the experiences of relationality. Here there are again two possible scenarios: Firstly that that this moderation occurs simply during the stressful events themselves (the 'stress-buffering' model); secondly that relational connection might in some way effect biological systems *irrespective* of whether people are under stress (the 'main effect' model). The idea that there may be different pathways at work is not a new one (Cohen and Wills, 1985:310-57) and studies correlating social support with reinforcement of components of both innate and acquired immunity (Miyazaki *et al.*, 2005:30-37) suggest social support affects immune function in a way consonant with both stress-buffering and direct effects, though the mechanisms themselves remain unclear.

The question then is whether, given the data and experimental limitations and difficulties outlined, it is possible to actually establish any causal connection or to investigate its potential mechanisms. Essentially this would seem to be a scenario of the kind alluded to earlier where questions have been raised within a discipline which cannot then necessarily be answered solely from within its own knowledge and resource base. The possibility thus opens up for the kind of transversal exploration outlined in the previous chapter. Furthermore, the data from the different disciplinary perspectives on the connection between relationality and health presented in this chapter appear to form a good basis from which to begin such an attempt. Theology and neuroscience (as represented by PNI) clearly have a shared interest in exploring the links between relational connection and health; moreover both theology and cognitive neuroscience have a shared interest in exploring the nature and enabling of relational connection in human persons. Thus there are at least two transecting lines here between the disciplines - one of van

Huyssteen's cardinal hallmarks for identifying a potential transversal space to be opened up.

The notion of relationality will thus be taken as a suitable location for the siting of a transversal dialogue between theology and neuroscience. Within this however, I want to further specify three specific arenas for exploration and exchange which will each then operate as a separate transversal space for which relevant contributions can be identified, examined and validated. These three sub sections are: relationality as basic; relationality as emergent; and relationality as realised. The first will address the role that the capability for making relational connection plays in the nature of humanness; the second will consider whether this capacity is explicable simply in terms of the possession of cognitive apparatus for various decoding tasks; and the third will examine the different ways in which such connection can be realised and experienced, and the possible effects of these. In each case, the transversal dialogue will draw on different material from the disciplines in different combinations. It will also take a somewhat different form each time, as a way of exploring various possible ways of generating transversal outputs. The aim of this three stage dialogical sequence is twofold: to build a case via the 'pervasive relations of mutual support' envisaged by Haack (2009:57) for a direct causal link between relational connection and health, and to explore and elucidate something more of its nature. The contention advanced will be that relationality represents an emergent phenomenon of cognitive function and thus its operational shape can directly moderate aspects of the systems which give rise to it.

The first step in this process is to establish to what extent the capacity for relational connection is a basic aspect of what it is to be a person, and what form this takes. This is the locus of the first transversal space engagement – which will be between theology and cognitive neuroscience – and will be the subject matter of Chapter 4.

In the Beginning is Relation

Relationality as basic

> *To be* and *to be in relation* becomes identical.
> (Zizioulas, 1985:88, original emphasis)

> When the eyes say one thing and the tongue another, a practiced man relies on the language of the first.
> (Emerson, 1860/2004:77)

> The sense of gesture is not given but understood, that is, it is recaptured by an act on the spectator's part […] It is as if the other person's intentions inhabited my body, and mine his.
> (Merleau-Ponty, 1945/2002:215)

4.1 Introduction and outline

The first step in the transversal project proposed at the end of the previous chapter is to explore the extent to which relational capacity can be said to be constitutive of humanness. The understanding that humans are fundamentally social creatures is hardly a novel one: from the ancient Hebraic ideas of *shālôm* outlined in Chapter 3, and on through the poetic imagery of Donne's much-loved *Devotion XVII,* to the Zulu maxim '*Umuntu ngumuntu ngabantu*'[11], the idea has been present through time and across cultures. Whilst the Cartesian turn-to-self inevitably triggered a fading of this apprehension in the West, an increasing discomfort with solipsistic accounts of humanness has recently fuelled a resurgence of interest in the social nature of humankind in a wide range of academic spheres. In the biological sciences, this has seen the emergence of social neuroscience with its explorations of the neural underpinnings of social behaviour; in theology it has stimulated a resurgence of interest in social understandings of the Trinity and the significance of these for praxis (e.g. Boff, 2000; Cunningham, 1998; Fiddes, 2000; Swinton, 2000), thereby generating a wealth of thick theological reflection.

[11] 'A person is a person through (other) persons'.

It is these two fields which will provide the voices for the first transversal space engagement between theology and neuroscience and in keeping with the methodological imperatives regarding selection and evaluation of material discussed in Chapter 2, each will be subject to critical scrutiny in relevant areas. In the case of theology, this involves demonstrating that the material put forward has been developed in ways consonant with the employment of postfoundational rationality. With respect to the scientific contribution, it takes the form of highlighting some of the issues connected to the tools used to investigate cognitive processes. Further observations in keeping with the epistemic evaluation criteria previously outlined will also be offered at appropriate places in the subsequent examination of the theological and scientific material.

Section 2 thus begins with a general examination of why the development and nature of the theological canons make them a suitable source of material for transversal space dialogue, before considering more specifically the suitability of the social trinitarianism of the Cappadocian Fathers as a contributor in this particular instance. Their revolutionary understanding of personhood is then used as a lens through which to reconfigure another potent and pertinent motif – creation in the *imago Dei* – as a further theological contribution. Here I argue that for each of the three ways this idea of human uniqueness has traditionally been interpreted, a 'relational' re-reading is not only valid, but also provides valuable insight for understanding the connection between humanness and relationality.

Section 3 introduces the scientific contribution by looking at a variety of issues to do with the use of dynamic imaging technology, the extent to which it accurately represents cognitive functioning, and to the inferences that can be drawn from such studies. It then examines whether neurobiological evidence supports a contention that relational capacity is an essential element of humanness. Here, two key areas are explored: the decoding of biological signals, and the activity of so-called mirror neuron systems (MNS). These are both increasingly seen as providing vital biological bases for social interaction and are currently the subjects of intensive investigation – although some of the extrapolations from this are controversial. Once again, as with PNI studies, material drawn on is indicative rather than comprehensive. The final section of the chapter brings these theological and

neurobiological explorations together to generate a transversal outcome to be carried forward as the basis for the next stage of the dialogue.

4.2 The theological voice

The Christian tradition contains a wealth of different canons – curatorial bodies of texts, doctrines, symbols, rituals etc. – relating to specific areas of thought and action. The strong contention offered in Chapter 1 and 2 that material from these can be put forward and defended as a suitable transversal partner for experimental neuroscience raises a number of significant questions to be addressed. Firstly, and of particular importance in this chapter, can understandings formed in response to philosophical or theological issues which may have long since disappeared, contribute insights which can still be interfaced with those of modern neuroscience? Secondly, can material evolved in connection with particular *religious* questions, be used in a dialogue whose intent extends beyond specific apologetics? The answer to these questions, and thus to the defence of the selected material, lies in understanding the nature of the theological canons themselves, and then in using the critical tools of postfoundational rationality to select and develop appropriate material from within these.

4.2.1 Galaxies and constellations: canons and their contents

As noted in Chapter 2, both conceptual development and experimental investigation within science are contextually embedded in particular research traditions and communities. One result is the generation of (sometimes radically) different paradigms of understanding clustered around key concepts under exploration. Similarly the development of theological ideas over the unfolding course of Christianity has produced varied (though not necessarily mutually exclusive) understandings on many key points. In a sense this is simply a reflection of the epistemic themes already rehearsed regarding the contextual situatedness of interpreted experience: different moments in history and the influence of different philosophical or cultural backgrounds generate different questions and emphases. Unsurprisingly then, within the various canons that make up the Christian tradition, specific theological understandings of key topics tend to evolve and change both as to formulation and emphases. Furthermore, the relative prominence of any canon within the total corpus of theological endeavour advances and recedes under the same dynamic. These features are perfectly illustrated by the history of

thinking related to the themes of the Trinity and the *imago Dei* employed in this chapter, which are both currently undergoing a resurgence of exploration and re-development in the light of recent changes in both the philosophical climate and scientific understandings.

Canonical collections are not however, simply loose aggregations from which any bricolage can be assembled at whim; neither are they inflexible deposits impervious to interpretative variation. Instead Brown (1994:55-74) has proposed the useful cosmological analogy of a galaxy: less circumscribed in form and trajectory than a planet and less arbitrary than a constellation, galaxies nevertheless have both gravitational centre and recognisable form but the latter varies according to the time and direction of viewing. Similarly canons comprise 'dynamic, richly plural and pluriform' collections of sometimes conflictual ideas which generate their own gravitational pull of meaning on the wider tradition. However this 'pull' is itself the product of the vast and complex array of possible meanings within the canon and of how these are, at any one time, construed (Brown, 1994:76-7). Thus, whilst retaining a core identity, canonical galaxies also give rise to different constellations of meaning, constructed through interaction with the different contextual challenges presented by different moments in history. The canon is not in itself a definitive answer or truth claim therefore – rather, its normative character is the depth of its fecundity, and its value is

> not the permanence of its solutions but the 'size' of its resources. Size means the multiplicity of visions it harbours, but it also means the fluidity with which it adapts meaningfully to changing circumstances (Brown, 1994:81).

In effect then, the emergence of different perspectives on key concepts, which are both connected to the core idea and responsive to the contextual situation, is not only a natural part of the canonical dynamic, but also necessary for the continued vitality of thinking within the Christian tradition. One can also argue strongly that it is indicative of both the employment of the gathering, binding, and evaluating tools of postfoundational rationality described in Chapter 2, and the continual search for the optimal understanding and increased problem solving capability which van Huyssteen designates as the hallmarks of the reconfigured epistemic task. The evolution of different readings of the *imago Dei* outlined later in the chapter, and the further development subsequently offered, is an illustration of this.

Thus theological canons by their very nature comprise rich collections of resources which can both contribute to, and benefit from, engagement with scientific perspectives in transversal dialogue. This does not however mean that all material they contain is suitable for the kind of work envisaged here. As discussed in Chapter 2 this, whilst acknowledging and retaining connection with the formative traditions in which experience is set and interpreted, also contains the absolute imperative to step outside of and stand in critical relation to these. Any material which is linked to fideistic claims to a special logic internal to theology, or to self-authenticating notions of divine revelation, and which also then claims privileged protection for these, is inadmissible to any transversal neurotheological dialogue aimed at a noegenesis which is generally appropriative. This then leads to the second question as to whether and how it is possible to use specific theological material without this necessitating a concomitant acceptance of other features of its generative framework. Here the nature of the topic under examination is critical: many of the most prominent interactions between science and theology both past and current have involved topics – creation, general and special divine action, spiritual experiences, soul, death and resurrection – which concern in some way or other the nature of the relationship of God (however conceived) to the world and the cosmos. However these require the acceptance of certain starting religious assumptions and thus have associated difficulties to negotiate; hence such interactions tend to become constrained into the apologetic outcomes which seem to be the hallmark of much science/religion debate.

However topics with a primary focus on the divine by no means exhaust the possible contributions which theology can make to exploration of the world. By its very nature, the religious framework has produced not only many different questions about what it is to be human, but also a wide range of material through which to rationally reflect on and grapple with these. Moreover, some of the understandings arising through this process, whilst they may have begun from religious questions, can be understood completely separately from them. From the dialogical perspective, this has two consequences: firstly, since the theological contribution does not depend on non-negotiable religious elements, all aspects of it can be opened up to critical inspection within the transversal space, thus fulfilling the necessary conditions of epistemic responsibility; secondly, since such insights are not inextricably tied to a specific religious *Weltenschauung*, their accep-

tance by other participating voices does not require a simultaneous assent to particular religious propositions or doctrinal formulations. Once again the evaluative skills of rationality, operating under the epistemic guidelines set out in Chapter 2, can enable the identification of material within the theological canons with the potential to be used in this way.

It is from these bases that the two particular theological contributions to this dialogue have been selected. They also explain the apparent paradox of a starting point which at first sight seems to be both esoteric and inescapably religious – the Cappadocian exploration of the internal relations of the Trinity. However, whilst originally undertaken to articulate a clearer understanding of God in the face of specific philosophical heresies, it also produced a radical reorientation of Classical Greek humanism and, in so doing, gave rise to important insights into the connection between person and relation. These have been recovered and further developed as part of the 20th century shift in the canonical galaxy of trinitarian thinking already alluded to, and it is as they pertain to the *human* experience and expression of relationality that they are of interest here. Thus the justification for the material is not one of it being *religious truth*, but of it being a *rationally developed perspective* on the role of relationality in the definition of personhood, and the following account of how the doctrine evolved functions to establish its *rational,* not its *religious* credentials.

Similarly the doctrine of the *imago Dei* also represents a core tradition of the Christian faith – arguably one of its earliest and most enduring ones. Essentially it represents the attempt to explore within the Christian framework the feeling – held across times and cultures – that humanity is somehow a special kind, different from the rest of the natural order. Once again the concept is not chosen because it expresses an inarguable religiously revealed truth, but because it introduces different perspectives which theological reflection has, under various stimuli, produced on this apparently ubiquitous apprehension. This particular canon is also, under the turn to relationality, currently experiencing a 'galactic shift' in which these understandings are advancing in new directions. Grenz (2001) for example has recently undertaken an extensive ecclesial/eschatological treatment of the *imago*, while van Huyssteen (2006) has produced a very different and detailed exploration from an evolutionary viewpoint. The project here is the much

more modest one of re-evaluating, through engagement with the Cappadocian insights into relationality, the classic substantive, functional, and relational understandings of the *imago Dei.* Although this draws on religious material and ideas, the understandings which are developed are not tied to the acceptance of specific religious propositions, but stand in the line of a postfoundational accountability. As such, and in the subsequent interaction with neuroscience, this represents a response to Welker's challenge to demonstrate that fundamental core concepts from historic Christian thought can still provide valuable stimuli and insights for contemporary understanding (Welker, 1999:2-4).

4.2.2 Social trinitarianism

The doctrine of the trinity is no longer 'one of the best-kept secrets in theology' (Peters, 1993:7). Instead, in response to changes in the philosophical climate (see Shults, 2003:11-32 for an overview of this), it has become a focus of exploration across 'nearly every ecclesiological tradition and theological persuasion' (Grenz, 2004:1). Amongst these, the recovery, restatement, and development of the social trinitarianism of the 4th century Cappadocian Fathers, particularly by Zizioulas (1985; 2006), has been important both in its own right and as a stimulus to other developments (Grenz, 2004:134; Russell, 2003:169). Some of the technical aspects of Zizioulas' model have been criticised (e.g. Torrance, 1996:288-93), and other aspects of his reading have divided opinion (e.g. Papanikolaou, 2004:601-7; Turcescu, 2002:530-36). However his interpretation and development of Cappadocian trinitarianism has served as the basis for a wide variety of relational theologies, with even his sternest critics appropriating and building on some of his fundamental insights (Grenz, 2004:145). Since the main interest here is not trinitarian technicalities per se, I will not discuss this aspect in detail (but see Grenz, 2004:139-47; LaCugna, 1991:53-79; Zizioulas, 1995 op cit., for detailed accounts and extensive primary references). Instead the focus will be on the insights into *human* relationality arising from the Cappadocian model as analysed by Zizioulas.

Far from being an esoteric pursuit involving abstract metaphysical speculation, the origins and development of trintarian thought were grounded in the practicalities of explaining experience and establishing identity: a key differentiating feature between Christianity and its parent religion being the former's very different experience of God. Against the background of *Yichud Hashem* – the unity of God proclaimed in Deut 6:4 and constantly reiterated in the "*Adonai Eloheinu,*

Adonai Echad"[12] of the *shema,* the early church had to attempt to make sense of what it understood to be a *threefold* experience of God in revelation, incarnation, and salvation. Thus it had to reconcile *oikonomia* (salvation history) with *theologia* (the mystery of God) in a way consistent with the monotheism that was both its core heritage and vital to its distinctive identity in a polytheistic world. This complex process extended over several centuries and was marked by distinct stages of development – often stimulated by the challenges of the prevailing philosophical climate. As such it clearly demonstrates identified features consistent with a post-foundational understanding of both rationality in action and the nature of the epistemic quest.

It was as in response to two such challenges that the Cappadocians made their vital contribution to understandings of the place of relational connection. During the course of this they fundamentally changed the concept and status of personhood, and in so doing instigated a revolution in Greek philosophy (Zizioulas, 1985:36). Up until this point of the 4th century, the prevailing philosophy (both Greek and Roman) held that 'personhood' (*prosopon)* – i.e. one's own unique identity/attributes – was something completely separate from and additional to, one's essential nature (*ousia* or *hypostasis*). In effect *prosopon,* as its original theatrical meaning indicates, was a mask held in front of *ousia*: the nature which existed behind the mask was primary, and the mask itself, the persona, merely a secondary identity in relation to this. However in response to Sabellius' claim that Father, Son, and Spirit were simply roles assumed by God and not full persons in the ontological sense, the Cappadocians produced a radical reconception of the nature of being. This involved firstly a linguistic and philosophical clarification which overturned the classical ontological primacy of substance and bestowed it instead on personhood – a complete reversal of the mask scenario outlined above. In this, *ousia* and *hypostasis* were firstly decoupled and then differentiated into a general predicate and its particular instance; the illustrative argument being that while there was one human nature (*ousia*), there were many human persons, and each of these could clearly only embody part of human nature since this survives their death. Hence individuals were not *ousiai* but *hypostases* (Basil, *Ep.*236.6; 38.5). Secondly they forged a never-previously made link between *hypostasis* and *prosopon* – essentially conjoining an ontological term with a socio-

[12] "The Lord is our God, the Lord is One"

logical concept. By so doing, they elevated the ontological status of personhood to a constitutive part of being itself (Zizioulas, 1985:39). Thus personhood was no longer to be seen as simply an *adjunct* of being, but rather as its actual hypostasis: the ontological principle is thus understood not as consisting in the *ousia* but in the *hypostasis* i.e. the person. This was a radical departure from Classical understandings, indeed it stood in opposition to all the Greek ontology against whose background it had been thought (Gunton, 1997:10; Jacobs, 2008:331-58).

The second crucial Cappadocian contribution was the establishment of an unbreakable connection between personhood and relation. This time the stimulus was the extreme Arianism of Eunomius who, in claiming that the *ousia* of God was his 'unbegotteness', thus excluded the Son (declared by Nicaea to be 'begotten') from the Trinity. Once again the notion of person was to prove critical: in this instance Cappadocian thought resulted firstly in the establishment of a clear and fundamental distinction between person and nature (Zizioulas, 1995:50), and secondly, in making a crucial link between person and relationship. Essentially they argued that since Father, Son, and Spirit share the same substance, their *particular* identities must come from the different properties of their personhood *viz* unbegottenness, begotteness and spiration. Such properties were unique to each individual and could not be communicated between them in the same way that their identical substance could. This definition of each person of the Trinity through the unique characteristics of their individual hypostasis rather than their shared substance allowed the new conception of 'person' as a distinct ontological category to emerge more clearly. It also underlined the idea that personhood is 'known and identified through its absolute uniqueness and irreplaceability' (Zizioulas, 1995:50).

The second significant element was their insight that the unique characteristic of each hypostasis within the Trinity existed only *because* of the relationship (*schesis)* between the Father, Son and Spirit: 'The Father is the name neither of substance, nor energy but of *schesis*' (Gregory Naziansus *Or.* 29). In a radical departure from the classical Aristotelian categorisation of 'relation' as an accident with no influence on the nature of substance, or role in defining it, 'Person' finally emerges as a distinct identity which only makes sense in relationship: as their trinitarian names imply, none of its persons can be conceived without reference

to the others, either logically or ontologically (Zizioulas, 1995:50). Thus 'being' can be understood as simultaneously both hypostatic and relational – in Zizioulus' famous maxim: '*To be* and *to be in relation* becomes identical' (Zizioulas, 1985:88).

This also gave rise to a very dynamic model of the Trinity in which there was a continuous movement of each person towards and through the others whereby the divine substance and life was shared, and relational identity was formed, but within which unique identity was also preserved. Whilst the mechanisms of this mutual interpenetration and indwelling (*perichoresis*/*circumincession*), belonging as they did to the interior life of the Trinity, were seen as remaining forever mysterious, what could be understood was that it allowed the members of the Trinity to retain their individual uniqueness whilst still sharing in the life of each other. Moreover this movement, in its transcending of personal boundaries as part of a 'communion of love', reveals *ekstasis* (moving out beyond oneself) as also being an essential component of relatedness (Zizioulas, 1985:46-7). The relevance of these aspects of the model to the emergent and realised dimensions of relationality will be addressed in the following chapters.

The question under consideration in this chapter however is whether relationality is a basic constituent of human being. The Cappadocian model of the social Trinity provides some vital input into this in various ways. In their moves to develop an optimal understanding of the nature of God, in response to particular experience and against a specific philosophical backdrop, the Cappadocians also produced a profound exploration and articulation of the nature of personhood itself. This established both its ontological nature and demonstrated that persons cannot exist in isolation: since personal identity is established through relationship, 'otherness' is a necessary ingredient in the realisation of personhood, allowing the emergence of unique and irreplaceable entities. The Cappadocian anthropology is thus one in which relationality is understood as an essential part of both human *being* and of human *becoming.* This understanding that personhood necessitates a dialectic of individuation and participation is remarkably prescient – anticipating the insights of writers such as Marcel (1948/2002), Macmurray (1961) and Tillich. Indeed the latter's comment that 'when individualisation reaches the perfect form which we call a person, participation reaches the perfect form which we call communion' (Tillich, 1951:176) would not seem out of place in a Cappadocian treatise.

Aspects of these understandings of the role of relationality in human *becoming* will be developed as part of the conversations in Chapters 5 and 6. With respect to the current dialogue however, the focus is on its role in human *being*. Here there are two important elements to bring forward: firstly that relationality is an integral part of personhood, an understanding which stands in sharp contradistinction to the growing individualism which has marked the Western view since Boethius pronounced a person to be *'naturae rationabilis, individua substantia'*[13] (*Contra Eutychem III.4*). The diametric nature of this prevailing view is beautifully captured in Fiddes' acute observation that in current usage, to have a product *personalised* is actually to have it individualised and privatised (Fiddes, 2000:17). The Cappadocian anthropology thus presents us with an insight on humanness which is radically different but which, as will become clear, is very much supported by and supports the current understandings of social neuroscience. Secondly, it suggests that relationality is not a later addition to the equation of humanness but a vital element from the outset. Thus relationship is not something *extra* which individuals can choose to enter or not enter into. Again this stands in contrast to the usual assumption that relationships exist *between* i.e. that they are only possible subsequent to the existence of two or more discrete entities (Cunningham, 1998:165). This is a theme which will be expanded further in Chapter 6 through the thought of Gabriel Marcel.

What emerges therefore from the Cappadocian contribution to trinitarian theology is a rationally developed understanding, from a non-scientific viewpoint, that somehow, the capacity for relational connection is a foundational aspect of what it is to be a human person. Whilst these insights can stand as a contribution in their own right to the chapter's transversal endeavour, they also serve as a lens through which, under the guidance of postfoundational rationality, the second of the selected theological themes – that of the *imago Dei* – can be re-examined.

4.2.3 The imago Dei

The idea that humankind is somehow distinctively different to the rest of the natural order is widespread across time and culture. In Christianity, this has been expressed through the enduring and potent motif of the *imago Dei.* However the concept itself has always been, for a variety of reasons, distinctly enigmatic.

[13] An individual substance of a rational nature.

Firstly, the form in which this 'fundamental and unique statement of biblical anthropology and theology' is couched in Gen 1:26-7:

> Then God said, 'Let us make humankind in our image, according to our likeness; and let them have dominion over the fish of the sea, and over the birds of the air, and over the cattle, and over all the wild animals of the earth, and over every creeping thing that creeps upon the earth.' … So God created humankind in his image, in the image of God he created them; male and female he created them.

is 'limited in its content, guarded in its expression, and complex in its structure' (Bird, 1981:130). Furthermore, the biblical texts themselves subsequently provide no systematic theory as to its intended meaning, and direct references are limited to a scant handful in the Priestly tradition writings at Gen 1:26-7, Gen 5:1-3, and Gen 9:6. The motif is also conspicuously absent from both the rest of the Pentateuch and the Prophetic writings. There is thus a striking discrepancy between its centrality in tradition and its minimal place in the canonical texts.

Additionally the precise meaning and significance of *selem* (image) and *demut* (likeness) is not clear from the text itself, and usage elsewhere is both abstract *and* concrete (Grenz, 2001:186-7). Moreover, neither of the two New Testament instances in which a directly analogous wording is used (1Cor 11:7 uses *eikon,* the Septuagint rendering of *selem*; James 2:3 uses *homioiosis*, its equivalent term for *demut*) are helpful in elucidating the actual meaning of the Genesis texts. Thus whether the terms are simply interchangeable, whether they each convey something subtly different, or whether the motif is in fact a theologoumenon whose primary purpose is to say something about *God* rather than about humankind (Barr, 1994:170), have all been widely debated. Despite these difficulties the statement is seen as representing a rare instance of the Old Testament canon offering a very direct and definitive statement concerning the nature of the relationship between God, humanity, and the wider creation. As such it has exerted a peculiar fascination for both theologians and textual exegetes throughout Christian history.

In fact the potency of the trope is such that despite exhaustive exegetical treatments of the texts and the existence of substantial consensus between biblical scholars on linguistic/textual matters (Bird, 1981:129-30), the subject continues to give rise to richly detailed theological exploration and articulation. Such endeavours reflect the understanding, in keeping with the canonical dynamic outlined,

that the meaning of such a central motif is neither exhausted nor absolutely constrained by the original authorial intent. On the contrary, not only is it open to further exploration and reworking in the light of ongoing evolutions of human knowledge and understanding, but there is an imperative to do so since '[e]ach century has the task of elaborating its thought ever anew on the basis of that indestructible symbol'(Ricoeur, 1965:110). Here, once again then, there are various indications of the dynamics of postfoundational rationality and its associated epistemic quest at work.

For the reasons already indicated, the focus in this chapter is not on issues of textual analysis *per se* (Grenz, 2001:186-203, has extensive references to key debates). Instead the interest is in the three historic theological perspectives on the motif – substantive, functional, and relational – as these reflect rational attempts to understand human uniqueness using the matter of a particular religious framework. Various aspects of these perspectives can rightly be criticised, particularly in the light of evolving social and ecological understandings, but this does not devalue their primary underlying insights. Nor does it preclude the possibility of re-imaging them – indeed to do so is to simultaneously obey the command implicit in Ricoeur's assertion and to respond to Welker's challenge (p114). A re-examination in conversation with the insights outlined in the previous section is thus proposed. Whilst the dangers of 'social model euphoria' (Horrell, 2004:419) and the attendant risk of projection (Kilby, 2000:432-45) are ever present, a postfoundational approach provides both tools and mechanisms to guard against an uncritical projection of prior commitments into the endeavour. Since the literature on each position is extensive, only a brief delineation of development, key elements, and issues is possible (but see Berkouwer, 1962:67-118; Grenz, 2001:141-82; Herzfeld, 2002:16-33; Shults, 2003:217-42; van Huyssteen, 2006:126-45 ; and Welker, 1999:60-73 for detailed accounts). For each position its core idea will also be reviewed and re-formulated in conjunction with insights from the social trinitarianism of the Cappadocians. These also allow the substantive, functional, and relational readings of the *imago Dei* to be brought together in a mutually illuminating way; and one moreover which has an important contribution to make to this first transversal engagement.

4.2.3.1 The *imago Dei* as a substantive property

This earliest – and historically most influential – reading in Western thought sees the *imago* as inhering in a particular property or capacity of human nature. Even prior to early Christian musings, reason was seen to be the prime candidate for this: Philo of Alexander declaring that 'The term image has been used here with respect to the director of the soul, the intellect' (*On the creation of the cosmos according to Moses 12.69*). Under the influence of the prevailing Greek philosophy this idea rapidly gained ascendancy and became established as the dominant interpretation. Unfortunately since reason was at that time perceived as essentially a male characteristic, this subverted the clear implication of the Genesis texts that all humans participate in the *imago Dei* regardless of gender or generation (Herzfeld, 2002:13). It also served to introduce a misogynistic element into the heart of the doctrine which became (and, in some contexts, continues to be) a source of discrimination against and oppression of women, and thus ultimately a very distorting influence on this reading.

The linkage between mind and image was further reinforced by Augustine:

> There is no doubt that man was made in the image of God, not according to the body, nor according to any part of the soul, but according to the rational mind wherein the knowledge of God can exist (*De Trinitate 12.7.12)*

and this in turn exerted a significant influence on the later developments of Aquinas, Luther, and Calvin (van Huyssteen, 2006:128-32). More recently the Augustinian line was developed by Niebuhr who, following Heidegger, expanded the idea of reason to include the capacity for self-transcendence (Niebuhr, 1943/1996:161-2). However this capacity, whilst going beyond reason, was still understood as being a function of it (Niebuhr, 1963:25). At the same time, whilst holding the body to be a defining part of our nature, Niebuhr also saw it as separate from the *imago* and thus bodily nature as standing in perpetual tension over and against this.

Some variant of this appeal to rationality/reason continues to predominate where substantive readings of the *imago Dei* are invoked. However it has tended, because of its associated difficulties, to be superseded by functional and relational understandings which do not have these particular difficulties and whose own associated issues are possibly seen as less acute. As such, this is clearly in keeping with Laudan's understanding of progress as set out in Chapter 2. However the

primacy, potency, and persistence of the substantive view are indicative of a powerful, deeply intuitive element to this way of understanding the *imago.* Arguably then it is worth re-evaluating despite its inherent weaknesses. Setting aside the problems already noted which specifically relate to the designation of *reason* as a locus, these take two main forms (Herzfeld, 2002:19-20). Firstly, all substantive interpretations essentially see the *imago* in individualistic terms, often then entailing frank or crypto dualism – as Niebuhr's variation clearly illustrates. Moreover, the resultant hierarchy of traits is almost invariably detrimental to understandings of the body and embodiment. Secondly, locating likeness in the existence of a necessary element which corresponds to a similar element in God produces an understanding which is essentially static: if the *analogia entis* rests simply in the *possession* of an attribute, then neither responsibility nor effort is entailed – there is no call to response or need for human effort to make up some moiety which is lacking for the fullness of the image. Ricoeur's criticism here is acute:

> The image of God is we believe the very personal and solitary power to think and to choose; it is interiority. According to such an atomistic interpretation of the image of God, I am an image of God and you are an image of God, but the facts of history cannot be coordinated with this divine stamp which is passive, immutable and subjective (Ricoeur, 1965:111).

However, the understandings discussed in 2.2 offer the possibility of overcoming these two problems by pointing towards a shift in the locus of the image-bearing capacity from **reason to relation**. This might at first sight appear to be simply conflating the substantive reading with the relational one which will be discussed shortly. However what I am proposing here is not simply a restatement of the Barthian view (p125 below) that likeness resides in the relationship with God/other. Instead it is one in which the substantive element is seen as indicating that both the possibility and necessity of relationship are a constitutive element of humanness. Defining the likeness in this way leaves it far less susceptible to charges of inappropriate individualism. Moreover, since it cannot be localised to particular areas or functions, and depends on embodiment for its realisation, then such a recasting also provides a way of negotiating the hierarchical and dualistic issues indicated above. Furthermore it enables a response to the second criticism of substantive readings since, according to the Cappadocian understanding, the role which relationality plays in constituting specific identity is far from static.

However this is an element which needs further development; and this is something which can be supplied by a similarly reconfigured functional understanding of the *imago.*

4.2.3.2 The *imago Dei* as a functional responsibility

Functional interpretations, developed mainly by OT exegetical scholars, have a much shorter lineage. However their advent early in the early 20th century significantly displaced substantive readings, replacing them with a much more dynamic understanding. Von Rad's proposal, taking up an earlier suggestion made by Hehn (1915:36-52,), and drawing on both linguistic analysis and extra-biblical resources, was that the *imago* texts of Genesis 1 were less to do with the *nature* of the image than with its *purpose.* Building on a comparative exegesis of the word *selem* (von Rad, 1973:57-60) he argued that Man was 'God's sovereign emblem' and that hence 'The decisive thing about man's similarity to God therefore is his function in the non-human world (ibid:60)'. Substantive accounts were further dismissed on the grounds that since the Priestly author is generally at pains to stress the infinite qualitative difference between God and man – for example the Gen 2:7 designation of men as dust – he is unlikely to be implying a shared attribute between the two (von Rad, 1964:390). The proposal was that the *imago* should be understood not as in inhering in an attribute we posses but located instead in the performance of a task we are called upon to undertake. Such a reading is not undisputed: Westermann for example is both sceptical about the use of extra-biblical resources to define *selem,* and critical of the contextual understandings which are evidenced (Westermann, 1984:24-5). Nevertheless it has become the favoured view amongst exegetes.

However this reading, whilst it may resolve some of the problems associated with a the substantive view, brings new ones: the textual interpretations of *selem* as akin to the images set up by kings to establish their sovereignty over land give it something of a viceregal 'feel'. This, alongside the close conjunction of the words in the Genesis 1 text, has led to this task being envisaged almost exclusively in terms of dominion over creation. Moreover, given the vigour of the language which the text employs to describe such dominion – *rādā* means 'trample' and *kābaš* 'stamp' (von Rad, 1973:60) – this has in turn come to be interpreted in a very specific way: humankind in God's image becomes the *'maître et possesseur de la nature'* of Descartes' famous designation (*Discourse on Method*: 6). Equally

unsurprisingly, such readings have been the source of much disquiet and criticism. Both of these have increased with the escalation of ecological uncertainties and disasters precipitated by the human exploitation of the natural world. Assorted theological and exegetical attempts have been made to address some of these difficulties, for example a move to the more relational focus discussed below, or the proposal of alternative exegetical readings (Bird, 1981:129-59), and understandings of dominion (Welker, 1999:60-73). Nevertheless acute problems remain for any functional readings tied to the notion of dominion. However in the light of relational perspectives set out earlier, and against the wider context of the Priestly tradition in Genesis, a different reading is possible which sees a move **from dominion to shālôm.**

The theme of chaos is a prominent element in the background of the primary *imago* text. Genesis 1, the distillation of the Priestly knowledge into concentrated form, essentially deals with the imposition of order on chaos: from the first move against the primal threat of the *Tohuwabohu,* via a series of separations and namings, disorder is progressively driven out and order and structure gradually achieved. As such the text reflects both the Priestly perspective that 'Chaos is *the* great menace to creation'(von Rad, 1962/2001:144) and the overall soteriological focus of the canon (von Rad, 1964:392; 1973:60). Against this background, and in conjunction with the relational insights discussed in section 4.2.2, a new development of the functional perspective – one in which the purpose signified by the possession of the *imago* is the responsibility to pursue and develop *shālômic* relationships at all levels – can be argued. Firstly, the Cappadocian model suggests that not only the capacity *for* but also the compulsion *towards* relationality is a foundational aspect of God/personhood. Moreover that it is through this latter that the hypostatic element of personhood is enabled and its full potential realised. In other words expression of relational capacity can be understood not just as a fundamental component, but as one which also contributes towards both proper order and stability, and the realisation of latent potentialities. Secondly, as discussed in Chapter 3 the concept of *shālôm* is deeply and organically connected to understanding the world as a place from which chaos has been driven back by God. Furthermore, pursuing and realising *shālômic* relationships within society is seen as a vital component of keeping those forces, with their destructive potential for individual, society, and nation, at bay.

These two perspectives can be conjoined to give a relationally informed reframing of the functional perspective. In this, the activity carrying the *imago* is understood as the *expression* of an inherent human capacity for relationality, something which is itself also a bearer of the image. Moreover this expression takes the *shālômic* form which characterises the relationships within the Trinity itself. It is through this type of relational engagement, with its resultant ordering and defence of society (and thus creation more widely) against the return of chaos, that humankind acts as God's viceroy. Such a reading is therefore consistent with the general concerns of the Priestly narrative in Genesis. Furthermore it not only preserves the dynamism and notion of activity undertaken on God's behalf which are core insights of the functional model, but also respects its apprehension that such activity is in some way connected with the proper ordering of creation.

What is beginning to emerge then is a reading of the *imago Dei* to which the traditional substantive and functional perspectives, reconfigured in conversation with insights from social trinitarianism, contribute different but complementary elements. The final piece of the picture is supplied through a reconsideration of the relational perspective as it has been traditionally conceived.

4.2.3.3 The *imago Dei* as relational connection

Once again the problems of a particular understanding of the *imago* have seen it displaced by one which does not carry these specific difficulties (van Huyssteen, 2006:137-8). Although Barth is usually credited as the father of these relational readings, their roots are arguably much older: both Hefner and Ramsey for example hold that the idea is present in Augustine (Hefner, 1984:331; Ramsey, 1950:255), whilst Grenz traces a fledgling form in the writings of Luther and Calvin. In these particular instances though, the image was seen principally as something which was reflected *through* man's relationship to God rather then *in* it. Thus the focus was on the *state* or otherwise of this relationship, and the extent or not to which the image was disfigured or completely lost as a result of sin (Grenz, 2001:162-70).

Barth's seminal approach is somewhat different: addressing the issue in a typically top-down manner he moves the interpretational focus from man to God, arguing that the image does not consist in anything humans are or do, but in their being 'a counterpart to God' (Barth, 1958b:184-5). Following the functional interpreters,

he too works from a textual exegesis of the Genesis texts. However his starting point for the exegetical key to the *imago* is not dominion but the creation of male and female in Gen1[27] (Barr, 1994:159). Arguing a connection with the gift of relationship bestowed by God, he understands image as inhering not in the *capacity* for relationship, but in the actual *relationship itself*: first and foremost with God and then with each other (Barth, 1958b:186). In keeping with his general predilections, Barth takes the 'let us' of Gen 1:26 [as] indicative of the existence of an *I-Thou* dialectic within the Godhead which forms the prototype for the *imago*. This is understood as being between the Father and the Son (the Spirit receives little attention) with the consequent hierarchical sequence that God lives firstly in togetherness with himself, then with men; and finally men live thus with one another (Barth, 1958b:207). The *I-Thou* dialectic of male/female relationship is taken as the prototype for *all* human-human relationship (van Huyssteen, 2006:137). However Barth subsequently also goes on to define the particularities of male/female relationship in keeping with a patriarchal concept of hierarchy (Barth, 1958b:288ff; and cf. Welker, 1999:66).

This understanding has been heavily criticised on the grounds that the male-female differentiation is inadequate both as an understanding of relationality within God's self and as a model for all human relations (Gunton, 1991:58). It has also been seen as speculative rather than exegetical, and as transposing too many of Barth's own modern presuppositions into the text (Berkouwer, 1962:72-4; Bird, 1981:131-4), with Barr labelling it an 'ill-judged and irresponsible form of exegesis' (Barr, 1994:160-1). There has subsequently been extensive debate on various aspects of the relationship between the *imago Dei,* human sexuality and the two Genesis accounts of creation (see Grenz, 2001:269-98 for an overview). However I do not wish to focus here on issues of sexual differentiation *per se* but on the foundational underpinning of the reading. Here once again a re-reading in the light of the Cappadocian relational perspectives offers the possibility of a further development of the relational understanding of the *imago* by moving its emphasis **from capacity to realisation.** This in turn may allow some of these problems to be solved and so facilitate progress towards optimising understanding.

If, as the Cappadocians argued, God is a community of persons inseparably related, then Barth's insight that the experience of relational connection is in some

way implicated in the concept of the *imago Dei* is a key one. However in limiting the specific content of the image to the male-female relationship, Barth introduces a restriction which is both illegitimate and unhelpful (Berkouwer, 1962:73; van Huyssteen, 2006:137). Moreover, the Cappadocian model sees divine relationality as extending beyond a call/response dynamic to involve something fuller and richer. Consequently any human relationality which reflects this must also mirror something of this expanded understanding of the taxis of relational connection. Thus despite its importance as a component of experienced relationality, Barth arguably significantly curtails the potential of a relational reading of the *imago* by limiting it to an *I-Thou* dialectic.

Obviously there is a caveat to be acknowledged here from the theological perspective *viz.* that all human knowledge and modelling of the divine must be understood as being subject to both noetic and ontological limitations. Thus the notion of perichoresis, with its mutual interpenetration and indwelling, is one which can only be applied analogously rather than univocally. Nevertheless, in as much as the Cappadocian understanding of trinitarian relationality expresses qualities which the concept of the *imago Dei* suggests humans *ought* to image, albeit within creaturely constraints, it indicates that certain features should characterise relational connection. Since this is a theme which will form part of the theological contribution to the transversal dialogue in the next chapter, it will not be explored here other than to note that such relationality involves both the creation of space in which the Other can come to fullness of being, and reciprocal self-giving. Indeed there is a sense in which Barth himself captures something of this latter in his insistence that true relationship between people involves the 'mutual giving and receiving of assistance with gladness' (Barth, 1958b:256). The suggestion here is thus that a reconfigured relational reading indicates that the *imago Dei* can also be understood not just as pointing to the necessity of relational connection as part of the divine order for humankind, but as also indicative of certain patterns for its experience and expression.

In summary then, Genesis 1 serves as a prologue to a more extensive Biblical narrative (Grenz, 2001:202), and whilst the *imago* terminology is absent from this larger panorama, what it stands for theologically is nevertheless one of its key structural themes (Mays, 2006:93). The re-examination of this theme using the

recovered insights of the Cappadocian understanding of relationality produces a number of results. Drawing on attempts to understand, from within a particular tradition, the implications of the ubiquitous apprehension of human uniqueness, it provides a way of renewing their insights in response to the current philosophical and scientific turn to relational frameworks of understanding. At the same time, whilst these new readings honour both the original context and concerns of the priestly narrative in Genesis, and the greater themes which these announce, the insights generated do not require additional assent to these – they serve as a framework of ideas and questions which were rationally developed, and are thus capable of further such evolution in the light of new understandings. Secondly, this refiguring significantly reduces the problem load associated with other substantial, functional, and relational ways of understanding the *imago*. In this respect it fits with the understanding of progress towards optimal understanding set out in Chapter 2. Thus in terms of both process and product, this further development of insights from the *imago Dei* tradition, displays the cardinal features of the operation of postfoundational rationality and its epistemic commitments Finally, it brings together all three approaches to the concept into a mutually illuminating triptych, in which each panel reveals a different perspective on relationality, and the whole gives a fuller understanding of the central concept of the *imago Dei.* Here this is interpreted not as a specific proposition about the connections between the divine and the human, but as an understanding of the connections between relational capacity and humanness.

Not only does this overall picture offer a significant contribution to the understandings which this thesis seeks to develop, but each of the three individual components is particularly relevant to a specific transversal focus. Thus the substantive view allows us to understand humans as *essentially* relational creatures. That is to say the capacity to relate is a fundamental part of the fabric of humanness, not an additional attribute: in short, relationality is revealed as basic to human being. The functional view captures the idea that this likeness is not merely a static possession of property but entails an active movement on our part to engage and develop this faculty. Moreover this is not just for the benefit of ourselves, but is part of a much larger relational dynamic which has evolved as part of the intrinsic structure of the world: thus relationality can also be understood as in some senses being an 'emergent' phenomenon. The relational perspective opens

a window onto the form such a faculty might take as it is expressed in this engagement: in effect it indicates a pattern for the optimum realisation of relational connection.

The themes of emergence and realisation form the subject matter of Chapters 5 and 6 and those particular aspects of the *imago* will be taken up and developed there. From the perspective of this chapter, considerations of the *imago Dei* developed in dialogue with the insights from the Cappadocians confirm and strengthen the theological argument for understanding the capacity for relational connection as being an essential and foundational element of what it is to be a human person. The underpinnings of human relational capacity have also become the subject of extensive scientific investigation generating an increasing corpus of experimental data. A consideration of these data, their strengths, limitations, and what inferences can be legitimately drawn from them, forms the second contribution to the chapter's transversal exploration.

4.3 The scientific voice

One problem for theologians attempting to engage with science has been an overeagerness to appropriate and build on scientific theories and data without sufficient understanding of either the meanings of the former, or the limitations of the latter. Thus when engaging with neuroscientific data, appropriate caution is needed: neuroimages are epistemically compelling – 'they invite us to believe' (Roskies, 2010:214) – but seductive though descriptions and pictures of brains 'lighting up' can be, the reality of such scans is infinitely more complex. Thus an appreciation of the possibilities and limitations of experimental cognitive neuroscience is needed before engaging with its data.

The scientific contribution to this thesis draws primarily on investigations of brain function. Typically this is conducted by one of three routes: neuro-anatomical (e.g. post-mortem or lesion studies); electrophysiological (e.g. EEGs and single cell recordings); and neuro-imaging (e.g. PET and fMRI[14] scans). For a good historical overview see Bechtel and Stufflebeam (2001:55-69). The latter group have been a significant factor in the explosive expansion of cognitive neuroscience, with more than 75% of the 10,000 fMRI studies published in the last two years relating to

[14] Positron emission tomography and functional magnetic resonance imaging.

this field. However whilst these techniques represent an immeasurable advance on Gall and Spurzheim's phrenological efforts in the 1800s, there are still significant points which need to be considered when assessing their results (see Seixas and Lima, 2011:1266-9, for a brief overview of key issues). This in turn is part of a wider set of issues connected with the interpretation of neuroscientific research. Understanding the limitations of these data is an important element of the criticality enjoined by the transversal space model.

4.3.1 From voxels to cognition

The focus of much cognitive neuroscientific research is the determination of the neural correlates of various conscious and subconscious cognitive processes. Experimental data are therefore chiefly measurements of different aspects of brain *physiology* – that is, of events at cellular level. However, since the object of investigation is the connection of these with higher function, data interpretation also usually involves a process of 'bridging to cognition' i.e. of drawing higher level inferences and interpretations from measurements of cellular level activity. A number of issues need to be highlighted here: process complexity; data interpretation, and experimental limitations.

The subject of brain complexity will be treated more fully in Chapter 5. For the purposes of this chapter, the important feature is the extent and manner in which activity in a particular region of the brain (the focus of PET/fMRI studies) can be connected to the higher cognitive function under investigation. In principle, brain structures can be conceptualised as information processing entities which receive and process input and then generate an output. But whilst this may describe the function of individual subcortical nuclei, the reality at regional cortical level is much more complicated, involving feed-forward and feedback loops between different regions, with outputs reflecting the balance between excitatory and inhibitory influences. However dynamic scans only measure levels of activity – they cannot provide any information on whether this reflects inhibitory or excitatory neuronal firing. Thus 'activation maps' produced by scans do not necessarily yield information on how neural activity in a particular region is involved in the task in hand (Masten *et al.*, 2012:112). Neither do they simply and unequivocally confirm its participation in the studied behaviour (Logothetis, 2008:870-1), indeed the validity of how 'reverse inference' is sometimes employed and extended has been challenged (Poldrack, 2006:59-63). There is also the more fundamental argument

that the bias in experimental neuroscience towards localising and modularising brain function does not reflect growing understandings of the distributed, multi-leveled, multitasking way in which the brain actually functions (Hardcastle and Stewart, 2002:572-82; Logothetis, 2008:876-7). The pluripotency of brain regions inevitably gives rise to a many-to-one mapping scenario between cognitive functions and their neural substrate, and thus there is an argument that region-based analyses of imaging data can only ever provide weak support for cognitive theories (Klein, 2012:952).This leads on to the second issue, that of the interpretation of study data.

The focus here is once again on the dynamic scans which provide most of the data, but all methods of investigation have inherent limitations: for example single cell recordings (the basis of the original 'mirror neuron' hypothesis) provide useful information about which stimuli activate a neuron, but cannot determine what role it then plays in processing that information. The critical point with fMRI scans is that what they actually record are measurements of the levels of deoxygenated haemoglobin (indicative of neuronal activity) in the blood in small sections (typically about $1mm^3$) or 'voxels' of brain tissue. These numerical data then require a sequence of complex mathematical processes to produce matrices of hundreds or thousands of numbers indicating activation in different voxels which are then mapped onto the brain. At each stage in the processes of data extraction and mapping, choices of various kinds have to be made including decisions about which subsets of voxels are going to be included in the analysis. These choices are themselves subject to a mixture of influences – a further reflection of themes discussed in Chapter 2 relating to interpretation of experience, location in specific research communities and their particular foci of interest etc. Moreover, the statistical analyses for such data sets rely on certain assumptions being met if inferences are to be valid – for example that errors are independently and identically distributed (e.g. that that errors for different observational time points are not correlated). The often significant problems with this tend to be ignored in the literature but non-conformity can have pervasive effects on both individual subject and group-level statistics, potentially yielding qualitatively different results across replications (see e.g. Monti, 2011:1-13 for an analysis of these issues).

Many studies also involve an additional layer of complexity as these voxel data are then correlated with very different sorts of data sets – for example self reported emotional states during the scanning task. This requires further levels of complex statistical computations and thus more opportunity for additional (and often crypto-) factors to influence results. A recent analysis of 55 such studies produced the rather provocative conclusion that 'it is quite possible that a considerable number of relationships reported in this literature are entirely illusory' (Vul et al., 2009:285). Whilst such claims were vigorously contested (e.g. Lieberman *et al.*, 2009:299-307; Nichols and Poline, 2009:291-3), Vul's detailed analysis (ibid:274-90) clearly highlights a range of interpretational issues arising out of the way these complex data sets are manipulated and underlines the need for a cautious and critical approach to building on them.

Finally there is the issue of how closely these experimental situations actually reproduce the type of cognitive processing that goes on in normal conditions. In a sense this is merely an elaboration of the perennial problem of testing under experimental conditions where contexts irrelevant to normal behaviour, and proxies for real events, can both produce anomalous results (Insel and Fernald, 2004:698-9). Here however the problem is particularly acute given the severe physical limitations which dynamic scanning imposes on the subjects and thus the sorts of tasks that can be undertaken (see Eisenberger *et al.*, 2007:1610 for a description of typical problems/limitations). Furthermore, because the basis of the scans is sequential measurement of changes in circulatory dynamics, both task and subsequent analysis are broken down into different components. However whether cognitive response is the result of such sequential brain processing is disputed (Lewis, 2005; MacKay, 1998:71-8; van Orden and Paap, 1997:585-94). Even if it does represent an accurate understanding of the mechanics, the question remains as to how closely the decomposition selected as the basis of experimental analysis maps onto *actual* brain sequencing (Bechtel and Stufflebeam, 2001:70-2). And once again there is the issue of whether examination of localised regions reflects the reality of distributed brain functioning.

Any attempt to link experimental data on brain physiology to higher cognitive processes thus has to negotiate various epistemic challenges. Indeed a certain degree of scepticism has been expressed as to whether dynamic neuroimaging

can yield any useful information about actual cognition – Coltheart for example has argued that no such study has of yet yielded data which can be used to distinguish between competing psychological theories (Coltheart, 2006:323-31). It follows that the conclusions derived from these experiments are neither so uncomplicated nor necessarily so definite as is sometimes presented in both the academic and the popular scientific press. Howbeit, data are steadily accumulating on certain aspects of brain function in connection with social interaction, which are believed to indicate the existence of dedicated cortical loci and processes connected with this. In the following review of these however, the caveats set out above need to be held firmly in mind. The aim here is to explore whether there is sufficient evidence, from a scientific perspective, to establish the premise that the capacity for relational connection is constitutive of humanness. To this end, data connected with aspects of social decoding and with the proposed existence of mirror neuron systems are examined, set against the general background of the 'social brain' hypothesis. Whilst this has both an evolutionary and a neurobiological aspect, it is the latter which the focus here.

The proposal that the human brain has a circumscribed and specific distributed network of highly interconnected systems dedicated to social cognition was first made on the basis of work with non-human primates. Brothers suggested that this 'social brain' had evolved to facilitate assessments of the dispositions and intentions of nearby conspecifics through processing information about movement, posture, facial expression, vocalisation etc (Brothers, 1990/2002:367-85). Imaging studies have subsequently given support to the idea that certain cortical loci appear to be specifically involved in activity regulating and integrating a variety of mental processes involved in social cognition (Frith, 2007:671-8).

Adolphs has proposed that there are three distinct stages to this cognitive process: social perception i.e. the detection of significant biological stimuli; central cognition i.e. the recognition, evaluation, and interpretation of the received material; and finally, social behaviour i.e. the effecting of an appropriate response to perception and interpretation. These steps involve various complex processes such as adding emotional content to experiences; assigning behavioural motivation to perceived actions, constructing internal models of the specific social environment, the people involved and their relationship to the self etc. (Adolphs,

2003:166-72). It is with the first two stages – detection and evaluation – that the primary focus of the material presented here lies. Aspects of individual studies will be discussed in more detail in subsequent chapters; here though, the aim is to give a general indication of the evidence for the existence of particular processing pathways connected with social interaction and the references are indicative, not comprehensive. Since the interest of the thesis is not primarily in the specific brain loci involved, neuro-anatomical detail will not be addressed.

4.3.2 Decoding social signals

A large volume of data, principally from fMRI studies, indicates that the brain attends to a range of different biological signals given out by conspecifics within its immediate social environment. Different regions of the cortex have been shown to respond to the perception of faces (Hoffman and Haxby, 2000:80-4; Kanwisher *et al.*, 1997:4301-11); to the recognition of a variety of basic emotional expressions (LaBar *et al.*, 2003:1023-33; Winston *et al.*, 2003:84-97); to the presence of other bodies (Downing *et al.*, 2001:2470-3), and to both human-like biological motion (Beauchamp *et al.*, 2003:991-1001; Grossman and Blake, 2002:1167-75) and intentional actions (Castelli *et al.*, 2000:314-24; Saxe *et al.*, 2004:1435-46).

4.3.2.1 Facial Decoding

Evolutionary processes have privileged the face as the prime means of transmitting the signals necessary to negotiate complex and variable social situations (Brothers, 2002a:67-8; Insel and Fernald, 2004:713). Face recognition and the analysis of facial expressions have thus become an important part of everyday interaction; moreover humans are skilled at making reasonably reliable judgement from relatively impoverished stimuli and are sensitive both to the signals themselves and to their contextual details (Adolphs, 2003:166-7). Evidence indicates that the visual cortex is selectively sensitive to faces (Puce *et al.*, 1996:5205-15) and that face processing requires both a different neural substrate and a different set of operations to object processing (Sergent *et al.*, 1992:55-62). There is also evidence that different aspects of facial information are processed separately and in different cortical loci (Allison *et al.*, 1994:821-5; Puce *et al.*, 1995:1192-99).

However, despite the fact that neonates have been shown to exhibit a strong orientation to faces within the first ten minutes of life (Ellis *et al.*, 1992:105), what it is not yet clear is the extent to which facial processing is innately specified and the

matter continues to be debated. There is a long history of evidence that neonates have a generalised bias towards face-like stimuli. For example they show a preference for highly schematic face-like patterns over other equally complex visual stimuli (Farroni *et al.*, 2005:17245-50; Goren, 1975:544-9; Johnson, 1991:1-19). However this may simply reflect more general pattern and movement preferences (Macchi *et al.*, 2004:379-83; Simion *et al.*, 2001:59-65) rather than indicate the existence of a discrete pre-wired 'facial' tendency, or that faces *per se* represent a special class of stimulus for neonates. Howbeit, there is also evidence that from their first days, infants can recognise their mother's face and discriminate between familiar and unfamiliar faces (see Gava *et al.*, 2008:563-4, for recent studies). There are also indications that they scan own-race and other-race features differently (see Wheeler *et al.*, 2011:1-2 for a summary of recent papers). Older infants demonstrate a very high level of facial preference and responsiveness (Sergent *et al.*, 1992:55; Slater and Quinn, 2001:21-4) and an increasingly sophisticated ability to discriminate and categorises faces in a variety of ways similar to adult processing (Frank *et al.*, 2009:161; Nelson, 2001:6-7).

Of all facial features, the eyes have long been held in folk-thought to be an important source of information, and studies indicate that the eye region is often used as a cue to predict the emotional and mental states of others (Wicker *et al.*, 2003b:139). fMRI studies also point to specific attention being paid to angle and direction of gaze (Hoffman and Haxby, 2000:80-4), and indicate that this feature seems to be present from very early in life (Csibra, 2003:447). Furthermore it appears that gaze direction and strength provide vital information about the degree of intimacy of the encounter (Kleinke, 1986:78-100), aid interpretation of emotional state (Adams and Kleck, 2005:3-11; Baron-Cohen and Wheelwright, 2001:241), and may influence facial recognition in young infants (Farroni *et al.*, 2007:396-404; Rigato *et al.*, 2011:20-34). Angle of gaze also indicates where attention is being directed and thus gives information about possible intentions: alterations of gaze direction produce particularly robust neurological responses in the cortex compared to other facial movements (Puce and Perrett, 2003:439-41). They also appear to significantly influence other elements of social decoding (see Senju and Johnson, 2009:127 for a review of studies).

Intimately connected with 'eye-reading' is another key facial processing skill *viz.* decoding expressions related to both simple basic emotions and complex emotional states (Shaw *et al.*, 2005:1410-19). Facial expression has long been known to be a powerful and efficient source of social information. Darwin himself noted from his own experiments that certain expressions were recognised by almost everyone (Darwin, 1872/2007:18-19). He also compiled the first evidence that despite linguistic and cultural differences, facial expressions of basic emotions were remarkably uniform (Darwin, 1872/2007:23) – an observation later confirmed by Ekman's seminal fieldwork (Ekman *et al.*, 1972; Ekman *et al.*, 1987:712-17). Since emotional expressions have specific roles in social interactions leading to rapid behaviour modification (Blair, 2003:561-72), accurate deciphering ability is vital. Once again there is evidence that such skill is present, at least in rudimentary form from a very early age. For example neonates can distinguish between happy, sad, and surprised expressions (Field *et al.*, 1982:179-81). As with other elements of facial cognition, the processes involved in emotion reading are complex and distributed: both fMRI and lesion studies indicate that in the facial identification of the basic emotions of fear, disgust and anger, each has its own separate processing system with a specific dedicated locus, and the ability to judge degrees of emotion (Calder *et al.*, 2000:1077-8; Phillips *et al.*, 1997:495-8; Shaw *et al.*, 2005:1410-19; Sprengelmeyer *et al.*, 1998:1927-31; Winston *et al.*, 2003:84-97).

Such processing is both rapid and bypasses conscious analysis – Darwin was again percipient in noting that the ability to detect very subtle and swift changes in facial expression often went hand in hand with a complete inability 'to state in what the difference consists' (Darwin, 1872/2007:17). Various studies have demonstrated that perception of a face with an emotional expression immediately evokes involuntary facial reactions in the viewer (Wild *et al.*, 2001:109-124; and see Wild *et al.*, 2003:17, for further studies). Moreover both the cognitive and muscular elements of such responses, as measured by dynamic scans and electromyography respectively, match subtle moment-by-moment alterations (Wild *et al.*, 2003:17-36), with the motor mimicry being so swift that it often produces no observable alteration (Lundqvist, 1995:130-41). Even when there is a matching alteration in the observer's features, this occurs too quickly to be intentional imitation (Condon and Ogston, 1966:338-47). In other words these responses are not

the result of conscious evaluation of emotional content but represent a much swifter, neuronal level response. This is now thought to be mediated, at least in part by the mirror neuron system which allows an instantaneous evaluation of emotional content via representation in the observer's corresponding cortical regions (further at 4.3.3 below)**.** Such social mimicry, which may also extend to cover vocal and postural elements, occurs in both infants and adults alike. Meltzoff (2002:19-40) gives a detailed review of studies involving babies and infants, and Hurley (2005:1-204) provides extensive coverage of recent developments in adult studies connected with this aspect. Both the detection and assessment of gaze details and the deciphering of facial emotion contribute to the development of more sophisticated aspects of relational connection such as joint attention, social referencing and attribution of agency (Sasson, 2006:392), something which is addressed further below and in the following chapter.

4.3.2.2 Movement decoding

Most work on the 'detection' stage of Adolph's sequence has been directed at facial perception. However, from an evolutionary perspective at least, the ability to interpret the actions of nearby conspecifics is also an important skill and there is now a growing corpus of studies looking at the role of movement perception in social cognition and interaction. Biological motion essentially refers to a biological entity engaged in a recognisable activity – thus for example humans walking or making eye and mouth moments or intentional, goal-directed hand actions. There appears to be something significant about the quality of such motion from which humans, even in the absence of other cues, extract detailed and specific information about what the observed organism is doing (Frith and Wolpert, 2003:431). Furthermore biological motion cues trigger very robust reflexive attentional orienting (Shi *et al.*, 2010:348-54) – something which is not surprising viewed from an evolutionary perspective. Studies also suggest that certain areas of the brain are specifically or preferentially sensitive to biological motion (Pelphrey *et al.*, 2003:6819-25); that movement and gesture are subject to complex decoupling in which evaluation of different contributory elements is distributed across various cortical loci (Beauchamp *et al.*, 2003:991-1001); and that dedicated neural systems are involved in these processes (Grossman *et al.*, 2010:1-8; Puce and Perrett, 2003:435-45). There is also evidence that this movement decoding is closely

linked to other processes involving the attribution and assessment of goal directed intentionality and thus of agency – I will return to this shortly.

Humans also appear to be extremely adept at recovering and extrapolating information about such movements from very minimal information. In Johansson's seminal work using point light sources, observers were are able to identify specific actions from movement pattern alone, and such processing appears to be extremely rapid (Johansson, 1973:201-11; 1977:365-76; Krakowski *et al.*, 2011:373,382). A recent study showing that infants as young as two days old are able to discriminate between point source displays of biological and non-biological motion (Bardi *et al.*, 2011:353-9) raises the possibility of this again being an innately specified process. There are also suggestions that the brain actively perceives and processes significant motion even when this is presented in the form of a still image (e.g. Kourtzi and Kanwisher, 2000:48-55, and see Blakemore and Decety 2001:562-3 for a review of other studies).

Point light studies additionally indicate that motion may give information about gender (Pollick, 2005:1247-65; Saunders *et al.*, 2010:1-10), emotion (Atkinson *et al.*, 2007:59-72), and gesture. In the latter instance, they demonstrate that humans can apparently identify actions as communicative simply from their motion trajectory, and also identify specific communicative gestures from these (Manera *et al.*, 2010:168-78). With respect to the interpretation of gesture, assorted studies also indicate that the brain discriminates between instrumental and expressive gestures and processes them through different neural networks, with the latter involving brain loci which are also activated during mentalising tasks (Gallagher and Frith, 2004:1725-36). Similarly it distinguishes between those that are body-referred (e.g. moving a tooth brush) and those that are purely expressive (Lotze *et al.*, 2006:1787-95). There also appears to be discrimination between goal-orientated actions and those with no specific goal, with the former eliciting a much higher level of neural activity (Koski *et al.*, 2002:847-55). All these are indicative of a key issue here *viz. the* fact that motion decoding seems to be inextricably linked with the discernment, attribution, and deciphering of the intentionality of other conspecifics.

Perception of the world in terms of agents and their intentional relations is a fundamental aspect of human experience. It has long been understood that our per-

ception of the actions of others is structured by intentional relations – that is, we do not read these actions as isolated movements through space, but always as movement *in relation* to some goal or object of attention (Barresi and Moore, 1996:107-22). Moreover, this spontaneous perception of others as intentional agents is universal across human culture (Lieberman *et al.*, 2005:889-901; Norenzayan and Nisbett, 2000:132-5). Once again evidence suggests that this cornerstone of social perception is present from the first year of life and that infants too are able to attribute intentional relations at increasingly sophisticated levels of analysis: from early in the first year of life they can discern the relational structure of concrete instrumental actions, by the end of it they can represent goals as specific to individual agents, and by early in the second year they can discern shared goals that organise collaborative actions (see Woodward *et al.*, 2009:187-222 for an extensive review of infant studies).

There is thus a wide ranging corpus of experimental data suggesting that the brain has particular mechanisms for decoding elements of movement and expression with social implications. The general caveats regarding interpretation of such data have already been highlighted. In keeping with the critical nature of the postfoundational epistemic stance, further aspects should be noted in conjunction with the studies surveyed here. Firstly, the numbers of subjects are often small and many studies are never precisely replicated. Additionally, as with the PNI studies, there is a strong research community identity around some of these avenues of exploration. As was discussed in Chapter 2, community embeddedness plays a strong role in how questions are formulated, and experience and data are interpreted. Moreover a certain circularity of referencing between papers is sometimes evident, which may give the appearance of more collateral support for certain aspects of the hypotheses under investigation than is actually warranted. These cautions duly noted however, studies of various aspects of facial expression and biological motion indicate that there is at least some evidence for the existence of specific cortical loci and dedicated neural processes for the perception and decoding of biological signals involved in social cognition.

The second stage of the process suggested by Adolphs is that of evaluation – adding content and assigning meaning to the signals detected from facial and movement observations in the first phase. In some ways the distinction between per-

ception and evaluation is somewhat artificial, since it is obvious from the studies already discussed that the complexity of the neural processing loops is such that the two cannot be so easily or so cleanly separated as such staging implies. This is particularly the case with the recently discovered mirror neuron system which appears to be simultaneously involved in both analysing signals and adding, both directly and via recruitment of other systems, evaluative content.

4.3.3 Mirror neuron systems

Mirror neurons were first observed nearly two decades ago in laboratory monkeys (Gallese *et al.*, 1996:593-609; Rizzolatti *et al.*, 1996:131-41). Since then mirror neuron *systems* (MNS) have moved from being a low-level neurophysiological phenomenon to holding a putative, though somewhat contentious, role (Lieberman, 2007:271) as major players in a number of high level cognitive processes. The original observation, made via single cell recordings, was that monkeys possessed motor neurons which fired not only when they performed specific actions, but also when they observed those same actions being performed. This led to the proposal that perception and action, far from being neurophysiologically separate phenomena, were in fact intimately connected through shared representation at neuronal level. The observed 'mirroring' was postulated as the mechanism for understanding the actions of conspecifics (Rizzolatti and Craighero, 2004:172): thus as actions are observed, the corresponding part of the observer's motor cortex is activated i.e. an automatically induced motor representation – identical to that which would be spontaneously generated *if they themselves were to do that action* – is formed. This automatic matching of observed actions against the agent's own motor repertoire enables them to 'read' the perceived action. In other words MNS transform visual information into neuronal knowledge about the action (Rizzolatti *et al.*, 2001:661-70) and Merleau-Ponty's observation at the chapter head seems thus to have been remarkably prescient.

Since single cell recordings in humans are not possible, studies of MNS have relied mainly on fMRI and EEG data. However since these each measure very different physiological markers of neuronal activity, there are significant issues with trying to reconcile their findings with the data from monkey studies. Moreover as previously discussed, it is not possible to determine whether the neuronal activity measured by fMRI studies is excitatory or inhibitory hence they may be measuring a very different phenomenon to the excitation recorded by single cell studies (Lo-

gothetis and Wandell, 2004:760). Thus the existence of MNS is still questioned by some – for example an extensive analysis of all MNS scanning studies published over an 11 year period concluded that, for various methodological reasons, these have not provided sufficiently compelling evidence to warrant the conclusions that MNS exist in humans (Turella *et al.*, 2009:18-9). Such critiques notwithstanding, the evidential data from fMRI and EEG studies is widely seen as confirming the existence of a human homologue of the monkey system (for a recent overview of current understandings see Rizzolatti and Fabbri-Destro, 2010:240-9). There are also some indications that such a system may be innately specified, although obtaining direct evidence is hard due to the difficulties of undertaking infant imaging studies. However a variety of studies using electrical and spectroscopic approaches have provided some indirect support for the existence and operation of MNS in early infancy (Falck-Ytter *et al.*, 2006:878-9; Shimada and Hiraki, 2006:930-9; Southgate *et al.*, 2009:769-72).

Adult studies (Iacoboni and Dapretto, 2006:945-8; Rizzolatti and Sinigaglia, 2008:115-38, provide extensive listings) suggest that MNS activity occurs not only in response to an extensive range of situations, but also operates with a high degree of subtlety. Thus there is apparently a response to both object and non-object related actions (Buccino *et al.*, 2001:400-4) with increased activity when the former are embedded in specific contexts (Iacoboni et al., 2005). There also appears to be a response to both goal orientated actions and those with no specific goal (Koski *et al.*, 2002:847-55) including intransitive communication actions (Buccino *et al.*, 2004:114-26). Moreover in the former group, activation still occurs even when part of the action can only be inferred (Jackson and Decety, 2004:260). MNS also seem to be stimulated when simply observing the goal of a particular dynamic hand/object interaction, rather than the action itself (Johnson Frey *et al.*, 2003:1053-8), with one recent study suggesting that the goal of the action itself might in fact be a significant factor in activation (Gazzola *et al.*, 2007:1674-84). There is also a suggestion that MNS may engage motor circuits predicatively, rather than just reactively, with activation anticipating the next move in an action sequence (Flanagan and Johansson, 2003:760-70). Evidence thus seems to suggest a complex system whose activity extends beyond mere recognition and representation of the motor acts themselves, to encompass and encode more complex information about context.

The rapidity and subconscious imitative aspects of facial decoding have already been noted, and given what is understood of MNS function, it is possible that MNS activity may play a vital role in this. The link between such decoding and emotional evaluation was also noted and arguably some of this may also be explained with reference to such motor MNS activity. Darwin noted that simulating emotion engenders it (Darwin, 1872/2007:369) and studies have demonstrated that reproduction of the characteristic facies of the six basic emotions leads to autonomic nervous system arousal comparable to that attending a direct experience of the emotion (Levenson *et al.*, 1990:363-84). However a much more direct route to emotional decoding has also been proposed namely the activation of a specifically *emotional* MNS – in essence something similar to the internally activated 'as-if-body-loops' hypothesised by Damasio as a way of explaining empathetic feelings (Damasio, 1994/2000:155-8). A variety of studies have sought indications of such a system by looking for evidence of shared neural substrates between the observation and the experience of particular emotions. Some of the most compelling evidence here comes from studies of disgust: results from fMRI and PET studies (Phillips *et al.*, 1997:495-8; Sprengelmeyer *et al.*, 1998:1927-31; Wicker *et al.*, 2003a:655-64) suggest that both the personal experience of disgust (e.g. as a response to a noxious smell) and the perception of it in others, share a common neural substrate in the insula. Additional support comes from lesion studies which show that patients with insular damage not only have a decreased ability to feel disgust, but also demonstrate impaired skills for recognising the facial expressions associated with it (Calder *et al.*, 2000:1077-8). Rizzolatti thus suggests that understanding the disgust experienced by others is not based on inferential or associative cognitive processes but on the activity of an emotional MNS (Rizzolatti and Sinigaglia, 2008:182). Such automaticity may possibly also explain occasional shared visceromotor responses – for example the reflex gagging that occurs when observing someone vomit. This highlights the fact that MNS (both motor and emotional) must also therefore involve a mechanism for maintaining self/other separation. How this is regulated is not understood, although there is some evidence that it may be achieved through lateralisation of function to right and left parietal lobes, with one side dealing with representations and the other the ascription of agency (Meltzoff and Decety, 2003:498).

Various studies involving the experience and perception of pain may also lend support to the hypothesis of an emotional MNS. For example subjects given a painful stimulus and then subsequently led to believe that a significant other had received the same stimulus showed identical activation of the affective part of cortical pain processing centres in response to both situations (Singer *et al.*, 2004:1157-62). Other studies too have demonstrated a partial cortical commonality between experiencing pain and perceiving it in others (Jackson *et al.*, 2005:771-9; Singer, 2006:857-9, for a review of other studies). For Rizzolatti the overlapping activations demonstrated by such studies

> confirm the hypothesis that the understanding of the emotive states of others depends on a mirror mechanism that codes the sensory information directly in emotional terms (Rizzolatti and Sinigaglia, 2008:186).

The observation that there is an instantaneous link between observation of an emotional state and a corresponding visceral reaction in ourselves is not new – William James noted as much, adding moreover that the former without the latter produces colourless perception 'destitute of emotional warmth' (James, 1890/1957:450). However it is important to note that, unlike the motor MNS, the existence of an emotional MNS has never been demonstrated physiologically. This raises an important issue with respect to evaluation of MNS studies and the role such systems might play in social cognition.

That the MNS clearly has a huge and intuitive explanatory appeal is evident in the way that its postulated role has spread beyond simply action perception to include emotional interpretation and also language evolution and development (Arbib and Rizzolatti, 1997:393-424; Fogassi and Ferrari, 2007:136-141). However the increasing tendency to postulate new MNS – for example 'echo-neurons' linking action and sounds (Rizzolatti and Craighero, 2004:186-7), or the proposed 'super MNS' regulating other MNS (Iacoboni, 2008:30) – coupled with suggestions that MNS may play a significant role in a host of social malaises and political behaviours (Iacoboni, 2009), raises legitimate questions about overextension into areas for which there is as yet insufficient warranting evidence. There is clearly a huge gap between the simple motor representations first postulated from monkey studies and the sophisticated emotional decoding and attribution of intention which are now claimed as due to MNS activity. However the mainstream trend in MNS thinking and investigation has increasingly been to extend its function in

humans beyond mere motor cognition to become also a tool of social cognition. Here the suggestion has been made that MNS representations supply not just information about the observed *motor* intention but also about the *prior* intentions which have precipitated it and thus about mental states attached to these. In other words it is suggested that the proposed simulations facilitated by the MNS are also the basis of theory of mind skills, and that the motor system itself constructs goals, actions, and intending selves as basic constituents of the world it interprets (see for example Blakemore and Decety, 2001:561-7; Fogassi, 2011:66-75; Metzinger and Gallese, 2003:549-71). However whether these leaps are adequately warranted by the experimental evidence so far available is highly debatable, especially given the limitations of dynamic scans and of some experimental design (cf. Turella *et al.*, 2009:11-17). Certainly claims that assorted MNS constitute the fundamental neural basis of human social cognition are not universally accepted. Jacob and Jeannerod (2005:21-5) for example have argued strongly that while simulating an agent's movements might be sufficient for understanding his motor intention, it is insufficient for understanding prior, social, or communicative intention (see Searle, 1983:79-111 for the distinction between prior and motor intention). They suggest moreover, with some justification, that mirroring processes cannot furnish two critical features which characterise human social cognition *viz.* the capacity to read one's own mind and the ability to ascribe false beliefs to others.

This ability to represent both our own mental state and the mental states of others and to distinguish between the two – that is, the ability to develop a theory of mind – is a uniquely human attribute. Whereas several of the monitoring processes described in this section and the abilities they support – for example the recognition of conspecifics – are common to preverbal infants, apes and monkeys, the structure and content of human relational reasoning and interaction far exceeds these foundations. These more sophisticated skills depend on two unique-to-human abilities: the ability to attribute mental content to others, and the related ability to represent triadic relationships – '*You*, and *Me*, collaboratively looking at, working on or talking about *This*' (Saxe, 2006:235). The development of such skills will be addressed in the next chapter, but from the perspective of this chapter, and with respect to the issue of MNS, it is reasonable to argue that these systems are necessary but not sufficient for the complexities of social interaction,

providing important scaffolding for other aspects of social cognition such as mentalising. Indeed there is some evidence, such as shared cortical loci (Gallagher and Frith, 2003:77-83; Ramnani and Miall, 2004:85-90), to suggest a particularly close association between the MNS and theory of mind processes.

To summarise the scientific contribution then: with respect to the question of whether the capacity for relationality can be considered as *basic* to humanness, the key question is whether social cognition is simply a by-product of general cognitive processes or whether it is a specific feature, supported by specialised and innately specified systems. Despite the methodological and interpretational limitations of dynamic scanning, the data they have generated are widely seen as confirming the existence of a network of cortical loci dedicated to aspects of social cognition. Whilst some aspects of this are acquired, contextual and volitionally based, those discussed in this chapter are both automatic, and cognitively impenetrable i.e. they occur outside of either conscious awareness or control. There is also evidence that such processes are present from birth or very soon afterwards, at least in a crude form. Whether such mechanisms are completely sufficient for social cognition is much less certain, as is the question of whether MNS extend beyond the field of action simulation to constitute a basic organisational feature of the brain. Although there is great intuitive appeal and obvious explanatory power in the notion that multiple MNS enable representations of both action *and* emotion to be made from a wide range of cues, the neurobiological evidence does not yet provide sufficient warrant for a strong claim to be made in this respect, certainly with regard to emotional mirroring. However the evidence for a motor MNS is rather stronger, especially when taken in conjunction with the data from studies of facial processing. Given the rapidity of facial and movement analysis, it seems reasonable to postulate close connections between the neural processes involved in these and MNS activity. As well as interacting to facilitate the reading of basic social information about nearby conspecifics, these decoding and mirroring processes also provide scaffolding allowing the emergence of theory of mind skills and thus ultimately of a capacity for relationality which extends beyond mere decoding as a survival skill. Thus despite the evolutionary question mark over whether sociality drove brain evolution, or resulted from it, and duly noting the caveats regarding MNS, the neurobiological evidence reviewed arguably provides some reasonably solid support for the contention that cognitive

mechanisms enabling relational interaction are indeed an integral and foundational element of humanness.

4.4 In the beginning is relation: a transversal outcome

Whilst van Huyssteen's dialogical model is geared towards producing interdisciplinary results, the focus in this thesis is, as indicated in the previous chapter, not on these *per se,* but on the possibility of generating *transversal outcomes* from each of the three planned dialogues from which a transversal argument and related model can then be constructed. Thus whilst there are clearly some promising points around which interdisciplinary exchange and illumination could be focussed, these will not be explored here, although doing so at a future stage would potentially bring additional depth to the exploration being undertaken.

The transversal task here has been to explore whether a case can be made for designating the capacity for relational connection to be a constitutive element of humanness. From the theological perspective, the argument has firstly been put forward that unique identity arises from relational connection, and that thus relationality can be understood as being an ontologically basic element of human personhood. Secondly that using this insight to explore and expand the understandings of humanness developed within the *imago Dei* canonical galaxy, not only gives additional weight to this view, but also reveals relational connection to be an intense and central dynamic of human life, as well as a reflection of a wider relational principle of order and stability. As such it also has important personal and societal consequences in its mode of instantiation, and thus carries a corresponding obligation for the fullest possible realisation. From the scientific side, the argument has been offered that despite various methodological issues, there is a substantial corpus of evidence to suggest the presence of dedicated cortical areas and specific processes enabling and supporting social cognition. The automatic and cognitively impenetrable nature of these, coupled with evidence suggestive of innateness, allows a claim for their ontologically basic nature to be made.

Thus both disciplines are able to offer arguments in support of the contention. However in both instances there are also weaknesses to the cases presented: despite its grounding in experience, the Cappadocian model is open to a charge of

being simply a speculative account about that of which we can have no knowledge. Similarly, given the textual ambiguities involved, readings of the *imago Dei* are also vulnerable to accusations of being a conveniently flexible framework onto which one can simply hang interpretations compatible with one's prior metaphysical commitments. From the perspective of the cognitive neuroscience contribution, there are clearly significant issues to do with data interpretation at a number of levels. These leave the studies open to a certain scepticism regarding both the adequacy of the research protocols themselves, and the accuracy of some of the interpretative claims offered. These issues are possibly heightened by the fact that many of the groups of studies are coming from within the same research communities and thus there are clear theoretical preferences as well as some circularity to referencing and evidential support. From this perspective, the gold standard of repeatability and independent verification has arguably not yet been sufficiently attained to support some of the claims and inferences made for some of the data, particularly those relating to MNS.

It can be argued that in neither case are these difficulties fatal to the perspectives being offered. Nevertheless they do weaken the degree of warrant which either discipline can be said to have for claiming, in its own right, to make a convincing case that relationality is a foundational element of humanness. However, if we approach this from a transversal perspective then, following the criteria of Haack's crossword model set out in the second chapter, the theological and neuroscientific perspectives set out in this chapter can legitimately be seen, in various ways, as offering interlocking mutual support for each other. There are thus good grounds on which to form and defend a transversal argument that relationality is a basic, a foundational, constituent of humanness. This understanding now serves as the starting point for the next stage of the exploration which takes up elements which have so far only been touched on in passing, for example the dynamism and recursion implicit in both theological and neuroscientific understandings of relational processes, and the suggestion that relational experience is itself a crucial element in enabling and developing relationality. In light of these, the question arises as to whether the capacity for relationality is *simply* the innate possession of certain mechanisms developed and conserved through evolutionary processes for decoding the biological signals of conspecifics as a basic survival mechanism, or whether in fact it represents something more rich and complex for which

these mechanisms are the underpinning. In other words, are there grounds for considering the capacity for relational connection as an emergent phenomenon – a case of 'something more from nothing but'? These questions will be addressed in Chapter 5.

Something More from Nothing But

Relationality as emergent

> Every resultant is either a sum or a difference of the co-operant forces […] Further, every resultant is clearly traceable in its components […] It is otherwise with emergents […] The emergent is unlike its components […] and it cannot be reduced to their sum or their difference.
>
> (Lewes, 1879:413)

> Swiftly the head mass becomes an enchanted loom, where millions of flashing shuttles weave a dissolving pattern-always a meaningful pattern-though never an abiding one; a shifting harmony of subpatterns.
>
> (Sherrington, 1951:178)

> [Love] sometimes finds its most generous enlargement in the acceptance of restraint
>
> (Vanstone, 1977:44)

5.1 Introduction and outline

The preceding chapter developed a transversal argument from theological and neurobiological bases that, contrary to the solipsistic account of humanness which has by and large dominated our view of personhood since Descartes, the formation of relational connection is in fact an intrinsic and inescapable part of what it means to be a person. This constitutes the first component of a wider transversal argument which the thesis seeks to develop *viz.* that the expression and experience of this aspect of personhood can directly moderate immune function. The subject matter of the current chapter is whether relationality – defined here as the capacity to form and sustain such connections – is more than simply the sum of the assorted neurobiological decoding processes which support it, and represents instead an emergent phenomenon.

Rooted in evolving understandings of the nature and behaviour of dynamic systems, the theory of emergence postulates that the self-organisation of complex systems generates novel and coherent structures, patterns and properties (Gold-

stein, 1999:49). These resulting distributed wholes are understood to not only be *irreducible* to their component parts, but also, against standard Newtonian mechanics, to be capable of regulating both these parts and the whole system in a *top-down* direction. Thus, far from being inert epiphenomena, and in defiance of the Aristotelian dictum retained by science that things cannot cause themselves, these complex dynamic wholes can exert active power over their own shape and functioning such that the system which gives rise to them is continually developed, shaped, and maintained by their presence and activity (Juarrero, 2008:279). Against a scientific backdrop dominated by reductionism and the related apprehension that all that unfolds in the universe is logically entailed by the fundamental laws of physics, the concept of emergence therefore presents a severe challenge to received wisdom in the arenas of both mereology and causality. Thus, like its Copernican, Darwinian and quantum cousins, it necessitates a significant paradigm shift within science, and as such is the focus of ongoing and vigorous debate.

As a concept, emergence holds great emotional, aesthetic, and intellectual appeal (Jackelén, 2006:623) and as such has been taken up by various disciplines and applied to systems and phenomena from cellular to societal level, generating a wide range of typologies en route (e.g. Cunningham, 2001:s74; Deacon, 2007:88-110; Fromm, 2005:1-23; Halley and Winkler, 2008:10-15). Goldstein (1999:49-72), Corning (2002:18-30) and Clayton (2006) provide useful historical overviews and guides to some of the issues related to such appropriation. From the perspective of this study, the particular interest is its application within neuroscience where emergence has been linked with both the production of consciousness itself and the development of various characteristics of consciousness (Clayton, 2006:vi, 107-55; Juarrero, 2002:150). The argument which this chapter seeks to establish is that relationality is also a candidate for construal as an emergent phenomenon arising from neurobiological systems – in this instance those dealing with social signal decoding; the overall thesis argument being that this provides one possible pathway through which the connection between social interaction and health outcomes discussed in Chapter 3 could be mediated.

To advance the case for designating relationality as an emergent property necessitates demonstrating that it exhibits key characteristics of these. However, be-

cause of both the inherent difficulties of defining, delineating, and studying emergent phenomena, and the assorted experimental and inferential limitations indicated in the previous two chapters, this is difficult to do solely from within the domain of cognitive neuroscience. Thus once again a transversal approach is adopted. In this instance, evidence for each of three cardinal features is presented predominantly from the perspective of one of the project's three contributory voices. First the presence of complexity, self organisation, and irreducibility to parts is considered through analysis of experimental data from cognitive neuroscience itself. The role of primary articulating voice then passes to theology; here the aim is not to produce a theological analogue of emergence from which to argue a case for its existence as a genuine phenomenon, but to examine, through a theological lens, whether relationality displays one of its characteristic features. The focus here is the notion that constraint is a necessary element in the expression of relationality, and the lens will be that of kenotic theology. An important aspect of the theological contribution is that, in contrast to that from the scientific voices, it examines the issue and discusses evidence at cognitive rather than cellular level. Since this is where the conscious, embodied experience of relational connection is located, there is a strong case that evidence for designating relationality as emergent must also be sought at this level. Theology's traditional concern with *anthrōpos*, and its significant interest in the making and breaking of relational connection in various dimensions, mean it is well placed for such an undertaking. Finally I suggest that evidence for downward causation can be adduced from the PNI data previously presented in Chapter 3. These three strands are then brought together in the type of transversal conjunction proposed in Chapter 2 to build the case for designating relationality as an emergent phenomenon with causal efficacy.

However emergence is itself still a very controversial and contested concept, with many critics claiming that it amounts to little more than a philosophically motivated promissory note. Taking emergence to be an epistemological rather than an ontological phenomenon, this stance holds it as simply a matter of descriptive inadequacy/incomplete analysis which will ultimately yield to further research. At the heart of this epistemological/ontological tussle lies the issue of supervenience – that is the thesis, widely accepted in science, that every high level phenomenon and property is 'fixed' or strictly determined by lower level properties – in essence

that there is no 'free lunch'. Unsurprisingly, this is closely linked to issues regarding causality which continue to be hotly debated both philosophically and scientifically. Such questions are of crucial importance here, since the idea of downward causation provides a vital fulcrum in the argument that the nature of realised relationality has a direct effect on immune function. Thus prior to attempting to gather evidence for relationality as an emergent phenomenon, it is first necessary to address the matter of emergence itself.

The chapter begins therefore by considering the challenges posed by emergence and arguing that *contra* assorted objections, it represents a genuine ontological phenomenon. This is done through an exploration of the tensions surrounding the central claim that emergent phenomena exert causal power – since this also lies at the heart of the thesis argument. This tension has a twin focus: firstly the *location* of any such causality, and secondly its *nature*. In both cases I argue that the problems stem in part from misapprehensions about emergent phenomena, but also that significant difficulty arises because, and in keeping with the idea that emergence thinking represents a paradigm shift, the wrong frameworks of reference are employed: substance metaphysics and Newtonian mechanics – within which these questions are routinely addressed – are inappropriate for the task and thus generate problems which are artefactual rather than actual. Since these matters (and subsequent chapter and thesis arguments) also depend on an understanding of complex system dynamics, a brief explanation of key aspects of these will also be incorporated as necessary at certain points.

5.2 Emergence: contours and challenges

The modern concept of emergence, first articulated by Lewes (1879), was formulated in response to late 19th century views of causality and methodology (Deacon, 2012:146-54). Subsequent attempts by the 'British emergentists' (Alexander, 1920; Broad, 1925; Morgan, 1927) to develop solid philosophical foundations for the concept stimulated vigorous debate but shed little light on the actual processes involved. The possible mechanics thus remained locked in the black box between the observed lower level inputs and higher level outputs (Goldstein, 1999:54) and the idea lapsed. But whilst it is inarguable that methodological reductionism has been an invaluable heuristic for the purposes of investigation, and that determinism as classically understood is sufficient for Newtonian mechanics,

their complete adequacy for explaining certain sorts of phenomena has continued to be questioned from within both the physical and the biological sciences. The advent of complexity theories (see Taylor, 2001, for a multidimensional account of this), Prigogine's seminal work on the thermodynamics of far-from-equilibrium systems (see Prigogine, 1997), the development of nonlinear dynamical systems theory and chaos theory, and the complex adaptive systems theory developed by the Sante Fe institute (e.g. Kauffman, 1996) have generated a serious and sustained challenge to the standard accounts of summation and linear causality. They have also provided tools and models for prising open the black box of emergence and throwing some light on the apparent aporeia which lie at its heart. Nevertheless, both the charge that accepting emergence entails giving up the causal closure of physics and the abandonment of physicalism (Kim, 1993:209), and the perception that emergence entails 'illegitimately getting something from nothing' (Bedau, 1997:377) continue to persist and be hotly debated.

Some of the chief difficulties underlying these tensions are rooted in confusion as to the nature of the novelty proposed in emergence scenarios. This in turn is related to that hegemony within science which holds the explanatory locus of things to be their constituent or material features, rather then their topological or relational ones. However emergence seems to be essentially associated with phenomena in which the latter dominate over the former in determining aggregate features. Thus emergents, rather than being 'things' are more accurately thought of in terms of forms, patterns or functions (Deacon, 2003:276). Moreover a critical element to understanding their properties – but which is not provided by the physical properties and laws of the system giving rise to them – is an additional account of the configurational regularities affecting their constituent reactions (Deacon, 2007:93). It is here that the increasing understanding of the dynamics of complex, self-organising systems plays a key role in clarifying the genesis and behaviour of emergent phenomena and the nature of the causality which they support.

The lack of terminological clarity associated with the key concepts particularly as these are used across different disciplines, further complicates matters. However following an extensive review of usage in the literature, De Wolf and Holvert

(2005:1-15) have provided a set of working definitions and these will be followed here. Thus In the following discussions **self organisation** refers to

> a dynamical and adaptive process where systems acquire and maintain structure themselves, without external control (De Wolf and Holvoet, 2005:7),

and in which 'structure' can be spatial, temporal or functional. In other words it is a spontaneously arising dynamic under which the system moves over time from a not (or less well) organised to a more organised state which entails a global coordination (Prokopenko *et al.*, 2009:12). **Emergence** references the appearance of

> coherent emergents at the macro-level that dynamically arise from the interactions between the parts at the micro-level. Such emergents are novel w.r.t. the individual parts of the system (De Wolf and Holvoet, 2005:3).

Emergents may take the form of properties, behaviour, structure, patterns, etc and arise at system level. While explanations cannot necessarily be completely rendered in terms of the physical properties of the constituents, the physical laws which govern these are neither superseded nor violated in emergent phenomena (Deacon, 2007:93). It is against these contours that the challenges presented by emergent causality must now be examined.

5.2.1 Parts and wholes: the location of causality

The question of causal location is inextricably linked with the inherent mereological tensions of emergence. The idea of the sum exceeding its parts is neither novel or without influence in Western thought: its lineage reaches as far back as Aristotle's musings on syllables in the *Metaphysics (VII)* and on Zeno's paradoxes of motion in the *Physics (IX)*, and it is central to the school of psychological understanding which developed from Goethe's concept of *Gestalt.* However the notion of irreducibility to parts which emergence entails has significant differences. Firstly, the wholes in question are not pre-given coherent entities in the way that words or *Gestalts* are, but instead are 'dynamical construct[s] arising over time' (De Wolf and Holvoet, 2005:2). Secondly, whilst supervenience is a critical component of their dynamic, emergents are, as Lewes' original description quoted above indicates, inherently *different from* and *irreducible to* the lower level components from which they arise. This latter feature sits at the heart of the disjunction between emergence and reduction. It is thus at the centre of some of the major objections raised against emergence, particularly with respect to the location of causality. These objections have been developed in a detailed and sus-

tained way by philosopher Jaegon Kim, primarily within the framework of the mind/body problem (Kim, 1991:257-65; 1993:189-210; 1998; 1999:3-36; 2005:36-69; 2006:547-59).

If the emergentists' twin commitment to both full supervenience and irreducibility to the subvenient base is not to succumb to dualism, it necessitates the adoption of some form of non-reductive physicalism. Kim claims this is incompatible with the causal closure of the universe, and thus that any such attempt to distinguish between higher level properties and their physical bases must always collapse back into standard reductive physicalism. The underlying premise is that sufficient causation at one level excludes sufficient causation at another level, and is based on his principle of explanatory exclusion that 'no event can be given more than one complete and independent explanation' (Kim, 1989:79). Kim's basic argument regarding the supervenience issue can be stated thus: Suppose an emergent M has causal powers and that an instance of it brings about another property M*. But, *ex hypothesi*, M* must have a basal state P*, on which it supervenes and without which it could not be present. Therefore M can only instantiate M* by bringing about P* (i.e. by downward causation). However M, as an emergent itself, also must have a realisation base P. And if M fully supervenes on P, then the presence of P is sufficient for the presence of M. Thus it follows by causal transitivity that P is causally sufficient for both P* and M* and the hypothesised causal efficacy of M is superfluous. Hence regardless of whether causation is understood in terms of nomological sufficiency or of counterfactuals, then unless we accept causal over-determination as normative, M becomes otiose and dispensable as a cause of P* (Kim, 1998:37-41; 2006:557-8). By thus undermining both the claim to irreducibility and the capacity for distinctive and novel causal contributions at higher levels, Kim appears to deal a fatal blow to the possibility of causally efficacious emergence: if higher level phenomena are fully supervenient then causality *must* reside in the lowest subvenient base (which Kim takes to be fundamental particles) and all causation at the emergent level is essentially an illusion.

Kim furthermore argues that a bare statement that a supervenient relationship holds between two sets of properties is relatively uninformative: for it to be useful, a deeper explanation of that which grounds and explains the relationship is needed. Thus if Emergentism says (as Kim claims) that this information is unavail-

able or even unknowable, then the supervenience condition on emergence is no more than an assertion that there is an in-principle *unexplainable* covariation between the putatively emergent properties and their base properties – something which 'cannot be considered a substantive positive characterization of the emergence relation' (Kim, 2006:556). In a similar vein Kim also designates the hallmark of irreducibility as essentially a *negative condition* rather than a *positive account* of what emergence really is. His case here is that whilst reducibility is a genuine relationship characterising two domains of properties, the same is not necessarily true of its absence. Thus the claim of irreducibility contributes no useful information as to the generation and nature of emergent phenomena. Hence he argues that for emergence to be taken seriously, there needs to be 'an illuminating positive characterization of emergence' which explains how and why emergents supervene on their base properties and why, in spite of this supervenience relation, they are not reducible to them (Kim, 2006:557).

However Kim's critique is itself open to various challenges: as Campbell's analysis demonstrates, his arguments are weakened by assorted terminological blurrings, *petitio principii* statements and self-contradictions – for example his invocation of nomological sufficiency is not justified by the concept of supervenience *as he himself expounds it* (Campbell and Bickhard, 2011:33-56). Moreover his causal exclusion stance leads to assorted and potentially serious difficulties connected with the downward drainage of causal power (Block, 2003:133-50). However the chief point of interest here is not in the fine detail of Kim's arguments themselves, but in whether the substance metaphysics which underpins them and thus frames and shapes his mereological analysis, is an appropriate background against which to explore the phenomenon of emergence; and thus whether it can actually furnish an adequate toolkit for its analysis, or provide a language suitable for its articulation.

Kim's criticisms are raised within an intellectual framework which has dominated Western thought since the Pre-Socratics. This holds and perpetuates the deeply entrenched metaphysical assumption common to both physicalism and Cartesianism, that the basic form of existence is 'thingness' (Campbell and Bickhard, 2011:34). Hand-in-hand with this privileging of substance, and exacerbating the difficulties of analysing emergent phenomena, goes a deep philosophical and sci-

entific bias in favour of the small. This 'smallism' assigns ontological priority to small things and their properties over the not-so-small things which they constitute (Wilson, 2005:38-41). However Bickhard has long argued, from a variety of perspectives, that such assumptions confuse and vitiate the project of developing a coherent and fecund account of emergence as a genuine alternative to physicalism and dualism (Bickhard, 2003:121-55; 2008:252-6; 2009:547-91; Campbell and Bickhard, 2011:33-56). A critical issue here is the already noted apprehension that the dynamics of interaction between system components are a key element in the generation of emergence. Indeed the original delineation of supervenience explicitly invoked novel forms of relatedness as a central feature (Morgan, 1927:15-6, 18). Complex systems theory has added to the understanding that emergence is essentially a phenomenon of process rather than 'thingness' and therefore needs to be studied as such. But while such a shift in perception is not without precedent in the sciences – as for example in the transition from 'phlogiston' to combustion – classic substance and atom assumptions still tend to dominate and thus constrain thinking. Hence process is still often conceptualised in terms of mechanistic causal interactions between fixed objects. This leads on to consideration of the second issue *viz.* the question of whether, in the light of the ongoing expansion of quantum understandings, the substance framework itself any longer constitutes an adequate normative metaphysics within which to cast our reading of the natural world.

Unresolved theoretical tensions and inconsistencies notwithstanding, such advances have cast sufficient light to move our understanding of the basic ontology of the universe away from its former locus in the particulate. Instead, quantum field theory has led to a reconception of particles as particle-like processes and interactions. Thus at the presumed lowest level of scale there are no longer recognised indivisible point particles, or distinguishable stable and extended configurations, only quantum fields-in-process. Unlike particles, such fields have no discrete extensional boundaries, being defined instead by the statistics and dynamics of wave function. At this level therefore, the distinction between dynamics and their supporting substrate disappears (Campbell and Bickhard, 2011:45-6; Deacon, 2012:167-8) and thus the whole validity of assigning ontological priority to substance has now been brought into question. Consequently a strong case can and has been made for shifting explorations of emergence (and indeed much else)

into an explanatory framework predicated on the primacy of process rather than substance (e.g. Bickhard, 2003:121-55; Campbell and Bickhard, 2011:33-56).

It is important to note here that the proposed move from substance to process metaphysics (especially since predicated on quantum understandings of the world) does not then simply segue into 'explaining' the difficult aspects of emergence as somehow reflecting quantum strangeness. Rather, by enabling assorted conceptual and explanatory defaults to be set aside, it opens up different spaces within which the questions surrounding emergence can be articulated and explored, and the critiques against it answered in a coherent and legitimate way. With respect to the specific issue of supervenience and causal locus, it enables a challenge to be made to the claim that causality is, *of necessity,* restricted to the lowest subvenient level: a crucial factor in Kim's account is that all causal power is located at the 'basal level' of elementary particles. Moreover these particles although *participating* in organisation, do not in themselves (as elementary) *have* organisation. Thus any organisation at this layer is simply a boundary condition and organisation *per se* can never be seen as a legitimate locus of causal power (Campbell and Bickhard, 2011:46-7); *ipso facto* emergent phenomena can never be causally efficacious. However if, as contemporary physics seems to suggest, there are no particles, and the basal level comprises instead quantised field processes, then this radically changes the situation: if all is in fact process then, since processes inherently involve organisation, causal power must be located in process organisation itself. Thus 'organisation cannot be de-legitimated as a potential source of causal power without eliminating causality from the world' (Bickhard, 2003:124).

This relocation of causality from particle to process removes its restriction to the lowest subvenient base and thus opens the possibility that emergent phenomena can also be a locus of causality; and if the world is recognised as being constituted in terms of organisation of process, then there is no longer any in-principle mystery to new organisations giving rise to causally efficacious emergents (Bickhard, 2008:254); nor is there any reason why this cannot arise from interactions at any level, or indeed between different levels. It also implicitly recognises the vital role which process and organisation play in any mereological reckoning of a system. Liberating causality from a substance straightjacket thus enables coherent ac-

counts to be developed of both emergent causality, and of how emergent phenomena can be both fully supervenient *on* and yet at the same time irreducible *to,* the systems components which give rise to them. Nevertheless the assumptions which go with two millennia of substance metaphysics are deeply ingrained in both our thought and language. Thus the proposed move, whilst opening up new possibilities for scientific and philosophical investigation, also demands a significant mental effort, but one which seems to be itself demanded by the new paradigm currently being ushered in by the complexity sciences.

However whilst reassigning the locus of causality defuses the mereological tension of emergence, it does not fully resolve that related to the *direction* in which its causality operates. Once again these difficulties arise primarily from framing this within an explanatory framework which is inappropriate for, and thus inadequate to deal with, the dynamics of complex systems.

5.2.2 Cause and constraint: the nature of causality

The nature of causation is a core issue for science (Ellis, 2008:69). The prevalent scientific articulation of causality is couched solely in terms of Aristotelian 'efficient cause' within a Newtonian framework; and the concept of bottom-up causation – i.e. that lower level action underlies all higher level behaviour, and that all interactions and mechanisms are ultimately based in the laws of physics with no remainder – sits at the explanatory heart of all strong reductionist views of science. Moreover Aristotle's dictum that 'in so far as a thing is an organic unity, it cannot be acted on by itself; for it is one and not two different things' *(Metaphysics IX.1)*, which has remained largely unchallenged throughout the history of philosophy and science, would seem to absolutely prohibit the idea that a system can act causally on itself. The claim that emergents exert *top-down* control over the systems which give rise to them is thus doubly contentious and hotly contested.

However the underlying idea is, once again, not a new one: Kant himself, in *The Critique of Judgement,* raised the possibility of a causality 'of a completely different kind' operating in the organisation of nature (Kant, 1790/2007:216-7). Evidence from complex systems research increasingly indicates that bottom-up, same level and top-down forms can not only exist concurrently but also act in concert to enable the generation of further complexity within systems (Ellis, 2008:34). Moreover it seems that the apparent contradictions arise not (as Kant

concluded) from a limitation of reason, but from the inadequacy of the Newtonian framework *itself* for capturing the shape and the behaviour of the complex systems that give rise to and are then influenced by emergent phenomena.

System behaviour essentially involves the reception and processing of inputs and the generation of outputs (e.g. as material, energy, or information). All systems possess a distinct, though potentially changeable, internal structure (their 'state') defined by their components and the particular relations of these *at any given instant* in time (Juarrero, 2002:110). They also demonstrate organisation in the form of the *unchanging* relationships among components which determine the system's 'class identity'. Thus while a system's state may change (a necessary condition for emergence to occur), its identity remains constant (Heylighen, 1989:27). Systems also have an external structure (their 'boundary condition') comprising the interactions between their components and the environment in which the system is situated, alterations in which can also affect the internal structure and thus the dynamics of the system. Characteristic behaviour, and the state to which a given system tends over time is represented by its specific 'attractors' i.e. its asymptotic behaviour ('attractor' thus implies/involves no force). States adjacent to the attractor are ones more likely to be visited by the system, and all states close by in its adjacent 'valley' – that is neighbouring configurations – are directed and channelled by its dynamics. Attractors thus provide evidence of the way in which the overall organisation of a system constrains the alternatives available to it (Newman, 1996:245-61).

Despite these shared features, systems display radical differences in the way they operate and in their degree of openness to the environment in which they are embedded. It is these differences which give rise to the possibility of emergent phenomena and to the difficulties of capturing them with the standard Newtonian descriptions employed for stable linear systems. These near–equilibrium systems are typically closed and deterministic and hence impervious to external influences. Their operations and outputs are proportionate to and completely predictable from their causes. Moreover their parts are essentially independent of each other, being only externally related, and therefore remaining unchanged by their place in the whole. This rigidity means that such systems can increase neither their entropy nor their complexity and thus they cannot give rise to novel features

or exhibit anything other than bottom-up causality. These characteristic are reflected by the three typical attractors of such systems – points, limit cycles, and torii – which are regular, described by two variables mappable on a standard two-dimensional Cartesian grid, and thus mathematically tractable (Juarrero, 2002:152-4; Newman, 1996:253-4).

However systems operating far from equilibrium (Prigogine's 'dissipative structures') realise their structure, organisation and function in a very different way. Firstly they have an openness which enables them to regularly receive energy, information, and/or matter from the environment. Secondly, they contain a large number of components which interact, both serially and in parallel, in non-trivial ways, giving rise to both sequential and simultaneous effects and events. Hence small alterations in input can generate disproportionate system changes; moreover these interactions lead to symmetry breaking and thus to alteration of both the interior and exterior structures of the system, paving the way for spontaneous self-organisation and the development of coordinated global behaviour. This in turn opens up new sets of possible interactions through which the system can continue to evolve or develop. Such systems thus become recursive and are characterised by complex feedback and feed-forward loops which may be either amplifying or dampening in their effects. In contrast to linear systems, attractors describing complex systems cannot be represented two-dimensionally and indicate that even though the system is still 'captured', the overall pathway of this is in fact multiply realisable (Juarrero, 2002:162). These 'strange attractors' describe ordered global patterns with a high degree of local fluctuation, and are indicative of the fact that the systems which give rise to them are governed by highly complex, context-dependent dynamic organisation (Juarrero, 2002:152-5).

It is the presence of such features which allow both the possibility of emergent phenomena and explain why these, despite being generated by local interactions, tend to be global in nature. It is also the reason why standard Newtonian mechanics are inadequate and even inappropriate as a framework for understanding and articulating them. Once again the problem is rooted in the bias towards investigation and explanation in terms of objects and their properties, at the expense of the processes and relations in which they are involved: since dissipative structures are, as described, essentially distributed patterns of dynamic relations

rather than mechanical processes, it is a fundamental category mistake to think of their causal powers in Newtonian terms. Hence rather than conceiving the causal power of the emergent entity in the classical mechanical way as an external force impressed on system components, top-down causality should be understood as exerting its effects through the operation of system constraints (Juarrero, 2002:131-50). Thus *whole-part restraint* is a more appropriate (and helpful) terminology to employ.

Self organisation and emergence – Taylor's 'moment of complexity – occurs in a narrow possibility space lying between conditions that are too ordered and those that are too disordered (Taylor, 2001:142-3). For a system to occupy this critical space between rigidity and randomness requires

> a unique balance of integration, cohesion and robustness at global level and, at the same time, differentiation and multiple realisability at component level (Juarrero, 2009:84).

It is in achieving and maintaining this balance that constraints play a vital role: rather than being primary properties of the system parts, they are in fact the relational properties these acquire by virtue of becoming integrated (rather than simply aggregated) into a systematic whole as the system organises, and which lead to the particular 'attractors' of its space state. In other words they influence the probability landscape of the system's behaviour leading to various forms of entrainment between its component parts (Juarrero, 2002:152-5, 162).

The critical feature of such constraints as regards their causal effects is that they are *context sensitive* – in other words, their presence ensures that what has happened in the system previously significantly affects what can happen next (a point I will return to in chapter 6). A useful analogy is to compare throwing a die with dealing a deck of cards: in the former, previous numbers thrown have no effect on future possibilities whereas in the latter, the chances of getting a particular card at any point depends on what has already been dealt. This second vignette is analogous to the action of second order constraints which can operate once a system is far from equilibrium. Here distributed wholes contextually constrain their parts by modifying their prior probability in real time. At first sight, this appears to restrict rather than enlarge the possibilities for the system. However, drawing on information theory, Juarrero argues in a strong and detailed way that whilst the imposition of such second-order contextual constraints limits the degrees of free-

dom available to the system *components*, the translation into a more complex differentiated whole enabled by this improves system cohesion and stability and enlarges the variety of states it can access. Thus the system *as a whole* acquires a much broader causal repertoire (Juarrero, 2002:131-50). She hypothesises that similarly high levels of self organisation occurring in the brain would allow access to different states with different properties than less complex and uncorrelated neuronal processes can achieve, suggesting that both consciousness and various aspects of self-consciousness such as intentionality represent novel emergent patterns. The argument of this chapter is that relationality is another such emergent, arising out of the integration of the decoding processes explored in the previous chapter into a complex whole.

Complex systems operating far from equilibrium are thus ripe with possibility for self organisation and the subsequent emergence of new properties – moments of complexity which inevitably involve the simultaneous realisation of some possibilities and the negation of others. Moreover as possibilities are actualised new patterns emerge which, in their turn, both impose new constraints and open up new possibilities for future trajectories of the system (Taylor, 2001:149). Another important point to underline here is that these new systems are not simply there, waiting to be unfurled along predetermined lines. Instead different potential trajectories become available which are themselves then changed as the system evolves or its boundary condition alters. Thus they represent

> uniquely individuated trajectories embodying irreversible discontinuities – both phylogenetic and ontogenetic – that emerge over time while simultaneously remaining open to the future (Juarrero, 2009:97).

This is an important consideration to which I will return in Chapter 6 when exploring the realisation of relational capacity and the immunological effects that the shape of this might have. However, from the perspective of this chapter, the critical point to be carried forward is that in both the appearance of emergents and the subsequent exercise of their power to shape the behaviour and further development of the systems which give rise to them, constraint plays a central role.

The challenges raised against the claim to the existence of causally efficacious emergence are thus by no means insurmountable. On the contrary, when considered within frameworks which are more suited to exploring the growing understandings coming from complex system and information theory, the concept not

only becomes much more coherent and defensible, but also opens up the new possibilities for philosophical and scientific understanding to be expected of a potential paradigm shifter. From the perspective of this chapter, the argument that emergence represents a genuine ontological phenomenon and that emergents are not epiphenomena but wield causal power is held to be defensible. Moreover certain hallmarks have been identified which can be now looked for as part of building the case for considering relationality as an emergent phenomenon outlined in the introduction. It is to the first of these – evidence for complexity, self organisation, and complexification at various levels, and to the contribution of cognitive neuroscience – that attention now turns.

5.3 Underlying complexity: a neurobiological perspective

That the human brain, with its 10^{11} neurons and 10^{15} connections, is an organ of staggering complexity seems to be so much the ultimate truism as to require little in the way of further supporting argument. However the aim here is twofold: firstly, to examine very briefly from a general (although necessarily restricted) perspective, whether neural networks in the brain behave as complex systems which can thus potentially give rise to emergent phenomena; secondly, to look specifically at whether the previously discussed processes for decoding social information show evidence of being connected together into such a system, or of giving rise to new features or processing abilities at higher levels of complexity. However whilst networks involve both structural and functional connectivity and thus must be investigated from that dual aspect, any attempt to think of the brain in terms of hardware and software is fundamentally mistaken: rather than being a computer with stored contents and subroutines to be called up by a particular program, the brain is a 'constantly shifting dynamic system […] the flow of a river in which patterns emerge and disappear' (Kelso, 1995:1). It is this which makes investigation and interpretation of neural networks so challenging.

5.3.1 Neurons and networks

Networks essentially process sensory inputs and program motor outputs, acting as the interface between the physiological and the behavioural level. Typically they comprise vast numbers of neurons hierarchically arranged upwards into columns and thence into functional areas. These make distinct contributions to in-

formation processing (Cohen *et al.*, 2008:46), but are also themselves interconnected. Once again there are significant practical difficulties to overcome in exploring aspects of their composition, connections and behaviour: the interpretational issues of dynamic scans were noted in Chapter 3 and moreover, such knowledge as they can provide is also limited to the regional and thus upper level of network hierarchies. Furthermore, cytoarchitectonic studies indicate a more subtle and complex scenario here than fMRI-based topographical divisions allow (Vogel *et al.*, 2010:364), further coarsening the level of information these deliver.

Alternative study tools have thus been developed such as modelling with artificial neural networks (e.g. Noriega, 2008:130-9); and newer scanning techniques such as resting state functional connectivity MRIs which examine spontaneous fluctuations in the BOLD signal in the absence of any externally cued tasks (see Cohen *et al.*, 2008:45-57 for an account of the technique and its possibilities). Parker (2006:82-7) provides a useful review of assorted investigational issues connected with these. However a critical issue here is not just the determination of the functional architecture involved, but the identification and analysis of the relational dynamics at work: structural connectivity in primates has been easier to elucidate than the main organisational principles of the connection patterns which link brain areas, columns, and individual cells (Sporns and Zwi, 2004:145). Nevertheless, there has been a steady increase in the availability of network connectivity data. Moreover the extension of graph theory analysis to neural networks (e.g. Bassett and Bullmore, 2006:512-23; Bullmore and Sporns, 2009:186-98; Stam and Reijneveld, 2007:1-19) and the development from this of new tools such as complex network analysis have increased understanding of connectivity data sets (Rubinov and Sporns, 2010:1059-69 provide an accessible introduction to this technique).

These data and their analyses provide evidence that neural networks display characteristic features of complex systems as described by Juarrero regarding both the presence of second order constraints and whole/part interaction. Thus for example networks show evidence of sensitivity to previous history (Merzenich *et al.*, 1990:293-311) in a variety of ways: neuronal activity depends not just on immediate input but also prior input (Fetz, 1993:188; Lockery and Sejnowski, 1993:132); networks are also pruned in response to experience (Craik and Bialy-

stok, 2006:132) – two features indicative of the operation of constraints. In this respect, the qualitative effects on spatiotemporal network dynamics produced by changes in network connectivity (Jirsa, 2004:183-204) are likewise suggestive. Neuronal networks also demonstrate entrainment (p158) with evidence of transient phase-coupling occurring between high and low frequency brain oscillations and producing synchronised firings in different parts of the network (e.g. Canolty *et al.*, 2006; Womelsdorf *et al.*, 2007). Whilst the mechanism of such couplings within and between different levels varies (Kelso, 2010:120), the net result is the coordination of neuronal activity in distributed cortical areas. This provides a mechanism for effective cognitive processing of complex information (Canolty *et al.*, 2006:1628).

As regards whole/part relationships and interaction, analyses increasingly indicate that networks clearly demonstrate 'small world architecture' – that is they combine high levels of local clustering and activity with short paths that link network clusters into a global network (e.g. Sporns *et al.*, 2004:423; Sporns and Zwi, 2004:145-62). Such arrangements provide a functional connectivity of high dynamic complexity and adaptability (Bassett and Bullmore, 2006:512-23). They also enable highly efficient segregated and distributed processing in a network (Achard and Bullmore, 2007:0175), something which is of vital importance in the whole/part balance within networks: complex systems involve effective functioning at both local and global level. In network terms this necessitates facilitating enough regional activation for information propagation on the scale needed for cognition at global level, without this local activity then invading the totality of the network. If this balance is not maintained – as for example in a *grand mal* seizure when there is hyper-synchronisation of the cortex to localised firing – the computational potential of the whole network is lost (Kelso and Tognoli, 2006:2).

The brain thus also displays a high degree of metastability in which locally segregative and globally integrative processes co-exist as complementary pairs in neural networks (Kelso, 2010:128). Each specialised cortical area performs its unique information-expressing role whilst being simultaneously largely constrained by its network connections to the larger system (Fingelkurts and Fingelkurts, 2004:851) – a feature suggestive of the part/whole connection typical of complex dynamic systems. Moreover it appears that these co-variant interactions continue even

when the brain is 'at rest' (Smith *et al.*, 2009:13040-5), something which is seen as a mechanism for exploring a variety of possible functional network configurations around particular anatomical network skeletons (Deco *et al.*, 2011:43-56). Again this is suggestive of the state and phase space system behaviour which typifies the ontogenic landscape of complex systems and their strange attractors (cf. Juarrero, 2002:151-62).

There is therefore evidence from a variety of perspectives that neural networks generally demonstrate a functional connectivity which displays the characteristic features of complex system operation. The next section considers from a more specific perspective whether processes involved in social signal decoding are part of such a complex system from which the capacity for relationality might thus be emergent.

5.3.2 The 'Social Brain' as a complex system

Evidence for the existence of a variety of innate processes enabling the decoding of basic social cues such as facial expression, biological movement, and emotional state was presented in Chapter 4. The question now is whether this account is sufficiently comprehensive, both as a description of the 'social brain' itself and as an explanation of human relationality. Considered through the lens of emergence this becomes a question as to whether these disparate mechanisms also operate as a complex system capable of giving rise to dimensions of relational connection which are more than simply a summation of the individual skills they enable. As with neural complexity, the notion that human relationality amounts to more than efficient decoding of conspecific social signals seem too truistic to warrant further exploration. However to claim that it is an emergent phenomenon with causal efficacy necessitates more than a statement of intuitive belief that such is the case. Thus it is necessary to examine whether experimental data from social neuroscience provide evidence as to whether the individual processes which enable social decoding are also components of a complex self-organising 'social brain' system.

Two issues need to be noted here. Firstly, the system being postulated involves a nested complexity: not only are neurons complex systems in their own right (Kelso, 1995:228) but, as suggested above, the individual neural networks supporting decoding are also likely to be self-organising. Hence the basic system

components are themselves complex systems. Consequently there are attendant difficulties with disentangling at which level experimental evidence of particular effects should be properly located. Secondly, data on the functioning of these component parts are vast, providing many perspectives from which supporting evidence could be adduced and it is simply not possible here to address even a fraction of these. In light of these two problems, any account offered must therefore necessarily be both highly simplified and the data seen as indicative rather than comprehensive. Although the division is somewhat artificial, I thus propose to present evidence of complexity in the form of exemplars under a twofold heuristic of connection and complexification.

5.3.2.1 Connection

Evidence previously examined in Chapter 4 suggests not only that dedicated brain regions deal with social processing but that each aspect of such decoding – down to extremely fine detail – is dealt with via very specific pathways and processing mechanisms. The pertinent issue here then is whether each element of processing proceeds independently, with outputs being simply collated at an end point prior to response generation, or whether mutual exchange of information is part of the basic processing itself. Many experiments studying specific elements of social decoding via dynamic scanning have also noted concurrent activation of brain regions associated with other decoding skills, but this does not of itself confirm influential connection of the type which is of interest here. Instead I will consider evidence from the perspective of two of the basic processes which were referenced in Chapter 4 – gaze processing and mirror neuron systems.

The first of these is an important decoding skill, present almost from birth and apparently commanding its own very specific processing pathways (see Frischen *et al.*, 2007:694-724 for a wide-ranging review). However there is also a growing corpus of evidence to suggest that aspects of gaze also affect and recruit other processing pathways and cortical loci such as those involved in theory of mind tasks (Conty *et al.*, 2007:3024-37; George and Conty, 2008:197-207). Thus for example assorted psychological and imaging studies in adults (e.g. Senju *et al.*, 2005:1474-96) indicate that direct eye contact modulates both attention and cognition, facilitating other face related processing tasks such as gender discrimination (Macrae *et al.*, 2002:460-64) and encoding/decoding of identity (Hood *et al.*, 2003:67-71). Similar effects on cognitive function are also seen in infants – for

example direct gaze appears to improve face recognition in young babies (Farroni *et al.*, 2007:396-404; Rigato *et al.*, 2011:20-34). Taken together such data indicate that gaze processing is possibly connected with other components of the social brain. Moreover evidence indicates that both the specific task demands and the social context influence which additional regions in the social brain network are activated (Senju and Johnson, 2009:127).

There is also a well-documented connection between gaze direction and emotional expression – the 'shared signal hypothesis'. Here, seminal behavioural studies indicate that when gaze direction is combined with the intent communicated by a specific emotion, perception and interpretation of that emotion is much swifter (Adams and Kleck, 2003:644-7; 2005:3-11). Thus anger and joy are more quickly read in combination with a direct rather than an averted gaze. Conversely, fear and sadness are more rapidly processed and identified when presented with an averted gaze. These findings have some supporting confirmation from electrical studies which also suggest that the very early processing of each element occurs separately but then quickly becomes integrated (Rigato *et al.*, 2010:88-97). Arguably these particular data may also indicate the presence of a variety of entrainment, (p158) with two separate components becoming synchronised to improve the speed and efficiency of processing of information with high social significance. Some corroboration for such a notion can be read from a recent study providing the first evidence that communicative intent signalled in auditory form influences interpretation of gaze direction (Stoyanova *et al.*, 2010:1765-9). Irrespective of the details of possible mechanisms however, the corpus of gaze-related data sketched here provide indications that different decoding processes, whilst specifically dedicated, are also connected together in a larger network which allows the possibility of mutual influence.

The previous chapter expressed reservations about the explanatory ubiquity increasingly assigned to mirror neuron systems (MNS) at all levels of analysis from the neural to the societal. Nonetheless some of the investigative data presented there can support an argument that MNS can be seen as performing an integrative function across the disparate elements of decoding. This in turn allows for the possibility of mutual exchange across the social brain modules as an integral part of processing itself. The suggestive features here come from a number of different

perspectives; and whilst taken in isolation none necessarily constitute sufficient warrant for the claim of integrative function, taken together they could be seen as providing reasonable grounds for proposing it. Thus at the most basic level there is the dynamic evidence of concurrent activation of cortical areas identified as MNS loci alongside others known to be engaged by the specific decoding task being undertaken. Secondly there is the issue of the observed rapidity of some elements of decoding response noted previously. For example although the reading of facial expression involves processing elements observable at both cognitive and muscular level, the assignation of initial emotional value occurs at a speed which far outstrips these or the possibility of conscious evaluation. The instantaneous motor (and possibly emotional) representations formed by MNS produce a form of direct 'neuronal' knowledge and it can be reasonably hypothesised that these could then contribute to an immediate additional input into the specifically dedicated decoding pathways. Finally, experimental data indicate that MNS representations can be formed not only when visual data is restricted but also predicatively when action sequences are under observation. Once again this raises the possibility that MNS have the capacity to provide additional and more subtle informational input into a whole range of other decoding processes. This is arguably also indicative of a wider connectivity existing between, and contributing to, individual decoding processes. This point leads us to the second category for consideration *viz.* that of evidence for complexification arising within/from these basic innate decoding processes. Here the exemplar I wish to consider is the development of mentalising or 'theory of mind' (ToM) skills.

5.3.2.2 Complexification

Whereas several of the basic social monitoring skills described in the previous chapter are shared with apes and monkeys, the ability to represent both our own mental state and that of others and to then distinguish between the two, is a uniquely human ability. These ToM skills enable us to attribute agency to others and make predictions about their mental states and behaviour; they also confer the related ability to represent triadic relationships – '*You*, and *Me*, collaboratively looking at, working on or talking about *This*' (Saxe, 2006:235). As such they represent a high end cognitive skill which if impaired, as for example in autistic spectrum disorders (ASDs), can lead to severe social handicap. The question here is

whether they represent a separate social decoding skill or whether they are evidence of complexification arising from other such basic processes.

In contrast to other social decoding processes, which appear as innately specified, ToM abilities are not present in neonates or young infants, even in rudimentary form. Instead they begin to appear at about 18 months of age with the development of joint attention and of proto-declarative pointing. Thereafter they progress through a series of well demarcated stages, becoming increasingly sophisticated in the process: second-stage skills, which appear between 18 and 24 months with the development of pretend play, involve the ability to grasp the concept of 'desire'; third stage skills, developing between ages 3 and 4, enable an understanding of false beliefs – indicative of the ability to understand that other people can hold different beliefs from oneself. Between 6 and 7 comes the understanding that other people can also represent mental states (i.e. that they can be thinking about what *the child* is thinking about); and associated with this, the capacity to understand 2nd order false beliefs (i.e. that others can have different beliefs about one's *own* beliefs). The final stage, usually appearing between the ages of 9 and 11, involves the development of highly sophisticated ToM skills requiring both cognitive and empathetic elements such as the ability to recognise *faux pas.*

Debate as to whether these skills are *necessarily* domain-specific (e.g. Stone and Gerrans, 2006:309-19) has continued since their existence was first postulated (see Saxe and Baron-Cohen, 2006:i-iii for an overview and some recent studies). In fact there is evidence that both domain-specific and domain-general cognitive resources are involved in ToM tasks (Saxe *et al.*, 2006:284-98). A recent review of imaging studies suggests the presence of an integrated network of several consistently involved 'core' regions. In addition other regions seem to be contingently involved in more minor aspects of ToM tasks (Carrington and Bailey, 2009:2313-35). It is also clear that in addition to specific reasoning skills, these tasks require the employment and integration of a whole range of basic social processing skills at a very high level of operation (something in which MNS may possibly play a key role). These two features suggest that the development and employment of ToM abilities can be understood, at least in part, in terms of complexification of the basic social processing networks.

Additional support for this can be adduced from the growing body of evidence linking ASDs 'with abnormal interregional brain activity' (Koshino *et al.*, 2008:289): I earlier suggested that the 'small-world' architecture seen in neural networks was both indicative of, and vital for, their successful functioning as complex systems. However both post-mortem and fMRI studies suggest a disruption of such architecture in ASDs (Wass, 2011:18-28) with typical findings indicating a combination of local over-connectivity and long distance under-connectivity. This raises the possibility that a lack of information transfer and synchronisation over large scale cortical networks can lead to impairment of the high level integration of assorted decoding processes needed for ToM operation (Just *et al.*, 2004:1811-21). As such it provides some indirect confirmation that such skills represent a complexification of these basic processes.

From an evolutionary perspective such interaction and complexification also makes sense: for an agent to survive, it must be able to detect and use regularities in its environment; and the more successfully it can build and maintain a maximally predictive internal model for this, the greater its chances of so doing. The degree to which the agent can model depends in part on its computational resources and in part on what 'language' it is implicitly restricted to or explicitly chooses when making its models (Crutchfield, 1994-9). Thus anything which increases the resources and expands the 'language' for modelling improves the models which can be made of different aspects of the environment – which in the social context is essentially a stochastic dynamical system consisting of other agents. Improving the coarse-graining capabilities of signal decoding enables more complex modelling and maximises the ability to respond appropriately, enhancing the chances of survival. Conversely, anything which impairs or restricts computational resources leads to less successful modelling and thus more difficulty in reading and responding appropriately – as for example in ASDs where the absence of aspects of ToM skills can lead to severe impairment of relational skills.

Data from different domains of experimental cognitive neuroscience thus provide some good general evidence that the brain fundamentally operates as a pattern-forming, self-organised system governed by non-linear dynamical laws (Kelso, 1995:26) – Sherrington's loom metaphor quoted at the chapter head seems to have been prescient as well as poetic. From the more specific starting point of

systems devoted to social decoding, there is also evidence suggesting that individual decoding processes are entrained to, or otherwise connected with one another, in a way suggestive of complex system operation and resulting in complexification of decoding skills. The chapter now moves on to explore the second designated feature evidencing an emergent phenomenon, and the articulating voice passes to theology.

5.4 Relationality and restraint: a theological perspective

The problem of infelicitous appropriation of scientific ideas has already been noted, and emergence with its rich explanatory potential may, as Rue (2007:835) indicates, present particular dangers for theology in this respect. However the aim here is not to produce a theological account of emergence through which to gloss the inherent difficulties or fill the explanatory lacunae discussed in section 2. Rather it is to use a theological lens to explore, at a level above the neurobiological, whether and how restraints might be involved in the development and experience of relationality. This will then become a piece of the interlocking evidence being built up in the manner described by Haack. In Chapter 4 (p127-8) I suggested that the proffered re-articulation of the three classical interpretations of the *imago Dei* linked each perspective primarily to a different aspect of relationality; I further argued that the functional re-reading reflected elements of the emergence strand and that it captured the idea of likeness as not merely a static possession but one which entailed 'an *active movement* on our part to engage and develop this faculty […] as part of a much larger relational dynamic.' A further exploration of this movement, and in particular the role which self-limitation may play in its development, is now proposed. The chosen vehicle here is that of kenotic theology, in particular the work of Hans Urs von Balthasar.

In keeping with the philosophical principles and methodological approach adopted in the thesis, the theological material is not intended to function as a species of inversely applied *analogia entis* (cf. Gunton, 1995:92-6): the accompanying degree of accession to a concomitant full-blown Christian ontology of the world which this would necessitate is debarred by the project's parameters. Instead it is once again offered as rationally developed and defensible insights

about relationality which thus have a validity and utility *beyond* the specific issues, theologoumena, and frameworks which have generated them. Hence if used with appropriate critically and care under the direction of postfoundational rationality, they need not be confined to a specific confessional context but can also be illuminating with regard to aspects of human relationality more generally. The necessary first stage of this process is thus to introduce kenoticism and outline why this theological canon in general, and the writing of von Balthasar in particular, constitutes a suitable and rationally defensible contributory voice here.

5.4.1 Kenotic theology: choosing and using

Like the *imago Dei,* kenoticism has a long history within the Christian tradition and its Judaic parent, and the conundrum of divine self-limitation has generated a wealth of richly detailed reflection over the centuries. As a fully fledged theological concept, kenosis is relatively recent, having first appeared in the writings 17th century Lutheran scholars. However its linguistic and conceptual roots lie in a very early text of the Christian canonical literature – the great *carmen Christi* of Philippians 2:5-11 with its 'ellipsis, rhythm, parallelism, and strophic arrangements' (Ward, 1999:21), and its dramatic but opaque assertion that Christ 'emptied himself' (*eauton ekenōsen*). Just as with the *imago* texts of Genesis, the passage itself presents a range of exegetical and theological challenges: many of its terms are rare in New Testament Greek and even rarer in the Pauline vocabulary and thus their precise translation and implications have occasioned much debate (Martin, 1998:2-3). Moreover, since it takes the form of poetic narrative rather than theological argument, the passage is marked by an additional level of ambiguity and creative tension: for example the phrase which introduces the kenotic declaration – *en morphē theou hyparchōn* (being in the form of God) – can bear both causative (*because* he was…), and concessive (*although* he was..) interpretations, with different implications for understanding the dynamics of kenosis (Gorman, 2007:148-63).

Given this background and the consequent variation in exegetical possibility, it is unsurprising then that the kenotic motif has, like the *imago Dei*, given rise to a range of different readings. These textual challenges are also joined by assorted, and sometimes severe, philosophical and theological ones regarding the nature of God, which have led to a cyclical waxing and waning of the idea across its historical trajectory. Such difficulties notwithstanding, the concept is still widely re-

garded as 'a valid theological option' (Davies and Evans, 2006:313). Moreover its canonical persistence, coupled with a recent resurgence of interest and energetic redevelopment of the core ideas, give some indication as to the strength and depth of the intuition that these provide an important tool for understanding aspects of both divine and human relational engagement.

In Chapter 2, I argued that a key to setting up successful transversal space exchange was the identification of intersecting lines of various kinds between different disciplines. Two such intersections are operational here: firstly, kenotic theology explores the issue of divine self-limitation, in particular how this operates in the development, functioning, shape, and consequences of relational connection – both within the divine life itself and with respect to engagement between God and the world. Thus there is a clear intersection of interests at the nexus of the role of restraint in relationality. Secondly kenotic themes are inextricably rooted in what might be described as a metaphysic of possibility. Challenging the classical account of God as the *actus purus* in which everything is always eternally realised and who is thus immutable and impassible, they suggest that on the contrary, in order for God to create and then interact with Creation, divine change and movement are necessary.

By essentially thus relocating the concept of 'greatest possible being' in highest *potential* rather than highest *simplicity,* kenotic trinitarianism can be seen as reversing the Aristotelian metaphysic in which actuality always stands higher than potential. This shift in perspective, anticipated by Heidegger in *Being and Time* (Heidegger, 1962:63), has clear and obvious resonances with the themes explored in connection with complex systems in section 2**,** and in the shift away from substance to process**.** Thus in both its basic subject matter and its underlying metaphysic, kenotic theology is particularly suited and well equipped to contribute to the chapter dialogue. However since its arena is extensive, a further winnowing is necessary in order to identify the strand which has maximum potential for contributing transversally.

The history of formal kenotic developments is relatively short; but as with the *imago Dei,* the trajectory of these is illustrative of the mechanism of postfoundational rationality in action within a theological framework. Shifts in focus, questions examined and solutions posited – as for example in the debates between

the Lutheran and Calvinist positions in the 17th century (see Ward, 1999:25-40) – reflect the evolving of theological thought as changing political, cultural, and philosophical landscapes have presented different hermeneutical keys for unlocking the kenotic chest. Similarly the range of kenotic-based exploration – from early wrestling with the Chalcedon conundrum of Christ's twin nature (Law, 2010:259-64; Pannenberg, 1977:307-23; Thompson, 2006:74-111), through 20th century explorations of the trinitarian life *ad-intra* and *ad-extra* (e.g. Bulgakov, 1933/2008; Moltmann, 2001:137-51; von Balthasar, 1988-98), to recent science/religion excursions into areas such as cosmic creation (Ellis, 2001:114-8), divine action in the world (e.g. Peacocke, 2001:21-42; Polkinghorne, 2001:96-106), transcendent experience (Karo and Friedenthal, 2008:823-36), and altruism (e.g. Jeeves, 2001:66-89) – bears witness to the normative canonical character outlined in Chapter 4 in which fecundity and depth of resources are key identifying features.

But whilst material from any of these three main areas could in theory furnish a theological contribution, in practice the first and third are less well suited to the specific task in hand. In the first case, the nature of kenotic Christological debates centred on which of the divine attributes were relinquished and whether renunciation was real or apparent, means they have not necessarily generated insights which can be easily applied outside specific philosophical-theological dogmatic pre-occupations. In the case of the various science/religion debates, the focus has again been very specific – for example on whether divine restraints occur at quantum, genetic, or anthropic level, and on the potential mechanics for any such kenotically-regulated intervention. However since the aim here is to produce a more general exploration of and reflection on the role of restraint in enabling the development of relational connection, such approaches again seem both too particular, and too difficult to separate from some of their faith-based foundations. Thus they too will not be drawn on here.

However the kenotic trinitarianism which developed over the 20th century offers a somewhat more promising starting point for this project. Although primarily concerned, like the Cappadocian speculations discussed in Chapter 4, with a set of noetically constrained and uniquely theological issues, its explorations have similarly generated some interesting insights into the development of relational connection, and ones which seem to offer the possibility of a more general applica-

tion. Within this arena the themes explored in von Balthasar's *Theo-Drama* (von Balthasar, 1988-98)[15] – the central portion of a trilogy[16] which arguably constitutes 'the masterpiece of twentieth-century Catholic theology' (Wigley, 2010:1) – seem particularly well suited to the project in hand. One of the most prolific, creative and wide-ranging theologians of the twentieth century, there is an increasing interest in von Balthasar's writings across a very broad theological and ecclesial spectrum (Gardner *et al.*, 1999:vii). From the perspective of this project he is also a peculiarly apt contributor in both the underlying attitude which drives his theological project, and the way in which he then executes this and presents the results.

Because of both the daring nature of some of his speculations, and the creative way he reinterprets the tradition of Christian thought, von Balthasar eludes easy categorisation: he is neither liberal nor conservative, Thomist or modernist. Whilst broadly guided by an analogical lodestar, he is simultaneously driven by a desire to overcome the isolation of the church from its cultural and philosophical environment, and this finds its form in a sustained openness to the world and to its rich cultural heritages. A coincident respect for these complex and multiple ways in which human nature finds expression, and which are a presupposition 'for God's speaking and being understood' (von Balthasar, 1986:204), leads him to the necessity of serious theological engagement with their myriad forms (Riches and Quash, 1997:136-7). This is very much in accord with van Huyssteen's template for a theological engagement directed by post-foundational rationality, and the result is a hugely wide-ranging, thick, and eclectic theology, developed through engagement with a rich variety of sources from an immense cultural and historical range extending well beyond the realm of Christian writing. Moreover the way in which he ranges over these sources, drawing out connections and knitting together disparate material, is also strikingly reminiscent of Schrag's description of transversal rationality in operation.

In addition, the originality which characterises his work (Kilby, 2012:4-5), and the creative way in which he then chooses to present his complex theses, also seems

[15] Hereafter references to the *Theo-Drama* will be given parenthetically in the form of volume and page number thus (TD1:1).
[16] *The Glory of the Lord; Theo-Drama; Theo-Logic.*

pleasingly complementary with van Huyssteen's approach: thus for example his conviction that dramatic categories are deeply suitable for giving expression to the ways of God (TD1:16-7) leads to the development of his innovative *Theo-dramatics* – a completely unique theological enterprise which 'summon[s] academic theology back from desiccated rationalism to a form and register that are vibrant and forceful' (Quash, 2004:143). Von Balthasar sees the development of a theological dramatic theory as a fruitful way of integrating various motifs of theological methodology: event, history, orthopraxy, dialogue, political theology, futurism, function/structure, role, and freedom (Nicholls, 2000:12-16). This enterprise involves thinking through the whole structure of theology on the basis of a model of drama which holds historical indeterminacy and creative purpose in tension (Williams, 2004:39). In this, horizontal and vertical time are intersected (TD2:66) to create a unique, paradoxical 'dramatic time' in which normal seeing is transcended. Thus things can be simultaneously apprehended from a different perspective – 'what is played out is a unique event and yet as such is a revelation of something timelessly valid, a metaphor, a parable' (TD1:351). As the drama unfolds and the audience becomes engaged, new horizons of meaning are opened up through which they can gain a fresh perspective of themselves and their situation in the world (TD1:308). Such dynamics are redolent not only of transversal rationality but also of those which govern the operation of the transversal spaces themselves. Thus in various ways von Balthasar's work seems admirably suited to the adventure of transversal exploration.

However it is also not unproblematic since, despite his astonishing range, openness, and creativity, he has been charged with being both too anthropo- and too andro-centric (e.g. Deane-Drummond, 2010:46-64). From the perspective of this chapter, the latter is particularly significant because of his use of some sexual analogies to explore kenotic themes. These aspects of his work have drawn severe criticism from feminist scholars for their misogyny (e.g. Beattie, 2006; Coakley, 2002) and for the etiolated account they present of women (Crammer, 2004:102). For von Balthasar, sexual difference constitutes one of the three fundamental tensions of human existence (Crammer, 2004:93, TD2:355) and thus becomes one important locus for his consideration of otherness. But whilst he uses this to open up 'some extraordinary new insights which challenge our assumptions about love and action', he also makes their appropriation more difficult by linking them to

'problematic "fixings" of gender roles' (Williams, 2004:47): for example in his assertion that man retains a primacy even while undertaking a divinely instigated kenotic stepping down from this; or the related implication that woman exists primarily as a means for man's self-recognition and fulfilment (TD2:373). This does not necessarily eviscerate this strand of his thinking of useful content, but since it is only one way in which he explores the dynamics under consideration here, it will not be drawn upon for this chapter. Kilby's critique that von Balthasar has a tendency to overreach, leading his theological method to presume something which the content of his theology rules out (Kilby, 2012:14-5, 65, 105, 114), must also be borne in mind. However this is probably less acute from the perspective of the project here, since the focus is not primarily on the theological positions which he arrives at or their religious implications, but on the insights on restraint and relationality which are generated as he pursues his wider explorations of trinitarian kenosis.

Von Balthasar's starting point for enquiry is the fundamental enigma arising from human awareness of its own finitude and contingency. The inescapable apprehension that I 'am', but I could 'not-be', raises questions about the division between the finite and the infinite, between being and essence, which are 'the source of all the religious and philosophical thought of humanity'. From the Christian perspective, this ultimately condenses into the question of why the world exists – since any notion of Creation being in any way necessary makes God indigent, contingent, and thus no longer the Infinite. Von Balthasar holds that no abstract philosophy can answer this question satisfactorily; only Being itself, as it reveals itself through our concrete encounter with its transcendental attributes of Goodness, Truth and Beauty can do so (von Balthasar, 1991:1-5). The Trilogy, with its triple metric of aesthetics, drama and logics, is thus von Balthasar's attempt to unravel – through engagement with different forms of human expression – that revelation-through-encounter. The project's lodestar comes with his theological *modus* of taking the events and actions of Jesus' life as an epistemic ladder into God (TD2:128).

Of particular interest here is the second volume of the *Theo-drama* (von Balthasar, 1993) in which he considers the chief players in the cosmic drama. A major part of this involves an exploration of the nature of divine and human free-

dom, and of what this then reveals about the relationship between freedom, its restraint, and their connection with what is 'other'. In keeping with the aim of raising material which can be offered for transversal appropriation, this discussion will not focus on outcomes with respect to the particularities of the trinitarian hypostatic identities (since this is a peculiarly theological concern). Instead the interest is with the underlying dynamics which give rise to these, since understandings arising from these are not necessarily tied to the accompanying theologoumenon.

5.4.2 Restraint, otherness and freedom – a kenotic perspective

The introduction of the *dramatis personae* immediately raises the critical question of 'who else can act if God is on stage?' The issue at stake is how finite freedom and infinite freedom can co-exist without the former being swallowed by the latter; or conversely, without the latter surrendering its own nature as infinitude (Nicholls, 2000:63). Drawing on Classical, Patristic, Thomist, and Orthodox sources, von Balthasar uses insights about God gleaned from his revelation in Christ to deepen and expand the rational metaphysics which posits the Divine as wholly other. From thence he explores the relationship between *essence* and *existence* in the Divine and the consequences of this for the nature and expression of freedom, particularly as this relates to the kenotic activity of God. However since human freedom is the only kind of which we have actual experience, von Balthasar begins his journey from man (*sic*) who, as both singular and plural is '*endowed* with freedom, condemned to freedom and given grace to exercise it, with *the power of becoming what he can* on the basis of his own nature and constitution' (TD2:195; emphasis mine).

As von Balthasar points out, there is something inherently contradictory in the notion of finite freedom: we have a direct experience of freedom, but also of its impassable boundaries, and how can something be free if it is constantly encountering restraints imposed by the limitations of its own nature? We are thus at one and the same time free, yet only moving towards freedom (Nicholls, 2000:66). Drawing on material expounded in the first volume of the *Theo-logic* regarding the co-discovery of the self and the world, and picking up a distinction drawn by both Patristic and Medieval writers, he unpacks this further by positing two dimensions to human freedom: freedom as consent, and freedom as autonomous

motion. The first he argues to be an inescapable 'given' with our mode of existence, based in an inherent apprehension of the Good *as* good, and representing 'a fundamental freedom […] that enables us to affirm the value of things and reject their defects, to become involved with them or turn away from them' (TD2:211). In contrast freedom as autonomous motion has, as its name suggests, a somewhat less fixed character which is located in self-realisation rather than giveness: each person must also decide for themselves what freedom is and under what form is should be sought; and both decision and subsequent execution is entirely in their hands. Thus freedom comprises both a primordial dimension which consists in consent to the Good, and a secondary, self-directed dimension of actualisation (Nicholls, 2000:68). Von Balthasar goes on to develop the implications of this in various dimensions and so eventually to proposing how finite freedom can be integrated with its infinite origin and goal without being subsumed into and lost in these. The primary aspect of interest here is how the bi-polarity of giveness and process is realised in the context of infinite freedom, and of what this then reveals about the role of restraint in the generation of otherness and the subsequent possibility of relational connection with it.

Central to this is von Balthasar's understanding (which draws heavily on the thinking of Bulgakov) that in the case of Divine freedom, the process aspect is radically different because *self-realisation* necessarily means something different within the Divine life: where infinite being and infinite self-possession are in complete concurrence, there can be no equivalent process of 'coming to be oneself' (Nicholls, 2000:72). For all created things there is, as Aquinas argues, an inescapable tension between *what* they are and *that* they are, i.e. between their essence and their existence (*On Being and Essence IV*). However in contrast God, as the self-declaration of Ex 3:14 indicates, is *ipsum esse subsistens* – uniquely the 'pure act to be itself'. It is the consequence of this perfect coincidence of *esse* and *essentia* – of haecceity and the activity which realises it in particularity – that becomes critical to understanding the nature of the divine freedom underpinning all trinitarian kenotic activity. Bulgakov's understanding of the divine life not as a *material fact* (in the way that the being of material things is), but as a *living act* based on ontological reality is helpful here. In conjunction with this, he draws a distinction between the life of God *according* to himself (i.e. as he is in his unchangeable essence), and the life of God *for* himself (i.e. as he lives out this essence for him-

self in the living act). It is in this latter aspect that the conjunction of freedom and self-restraint is manifest: God, by virtue of his nature is completely free, but this very fact means he is also free to do what he will with his own nature – including to place restrictions on the way this essence is expressed in the living act of the Divine life. Hence it is not the *presence* of a restriction to infinite freedom which would contradict divine absoluteness or aseity, but the *impossibility* of such a self-definition on God's part. Thus whilst the ontological and substantial fullness of Divinity in the tri-hypostatic relationship of Father, Son, and Spirit cannot be changed or diminished, the fullness of the life of Divinity *for itself* can be limited – not from without, but internally by Divine choice (Bulgakov, 1933/2008:221-3).

The final piece of the jigsaw requires a further examination of how this dynamic can then be understood as operational within the life of the immanent Trinity and of what role constraint plays in this. For von Balthasar, these interior dynamics become visible through the kenosis of the Incarnation, the events of which he understands to constitute an economic expression of the eternal kenosis at the heart of the Trinity (McIntosh, 2007:391; von Balthasar, 1990:90-1). Moreover this is not revelation of a static icon, but of the dynamic movement of Divine self-realisation (Murphy, 1995:146). So to the Cappadocian insight that the unique hypostatic identities of Father, Son and Spirit exist because of the *schesis* between them (p117) von Balthasar now brings those arising from his examination of the nature of divine freedom to produce a 'galvanised ontology of divine life' (Quash, 2004:151). The resulting exposition of the perichoretic self-donation and simultaneous mutual constitution at the heart of the Trinity which such freedom enables, is not simply an abstract speculation but is firmly rooted in his overall Christology and facilitated by the extensive, critical engagement with other sources which is his hallmark.

However before further discussing how von Balthasar understands the role of freedom and restraint in this generation of Otherness, it is necessary to note a caveat. There appears on occasion to be an antimony in his account between equality and hierarchy, something which has attracted criticism, particularly when this is seen as extending into gender analogies (e.g. Tonstad, 2010:603-31). However the difficulty is in no small part a linguistic one: whilst the kenotic life of the Trinity is understood as existing prior to time, any description of it is necessarily

given from, and must use the conceptual language of, an inescapably temporal perspective with all the limitations that this involves. Hence it is impossible to talk of 'generation' without the idea of a beginning intruding and thus the inevitable feeling that the coming into being of the Father and the Son constitutes a hierarchical event, rather than one of eternal simultaneity. Adjectives such as 'active' and 'passive' are similarly baggage-laden. Whilst the consequences of this are more of an issue from a strictly theological/confessional perspective and do not significantly impede the general insights I wish to draw here, it does pose difficulties for delivering a coherent and consistent account of Trinitarian kenosis; it thus needs to be borne in mind here whenever terminology or constructions irresistibly imply sequential rather than concurrent events.

The epicentre of von Balthasar's exposition is an understanding of Trinitarian differentiation as being established by the relations of origin which constitute the persons as Other – the 'eternal interplay of active generation and passive being begotten and being breathed forth' (TD5:87-8). At the heart of this hypostatic determination lies the deep paradox outlined above in which freedom *uses* itself to *limit* itself. Thus the fulcrum on which the possibility of both otherness and relational connection turns is that of constraint. Von Balthasar begins his explanation of this from the standpoint of the Father, and of his absolute renunciation (in keeping with the Divine nature as love) of any possibility of being God *for himself alone* (TD4:323). The inevitable consequence which follows is a letting-go of the divine Being as the Father begets the co-eternal Son; the self-same nature and impulse means that there is a simultaneous and reciprocal letting-go by the Son as, in accepting the image of the Father, he allows himself to be so begotten; similarly this movement and exchange generates the hypostasis of the Spirit – whose 'I' is thus also the 'We' of Father and Son (TD2:287).

The infinite freedom which marks the Divine life plays an important role in these movements in a number of ways, and in each instance, restraint plays a vital role in the operational dynamics. Firstly, for each of the three Persons, the process of hypostatisation involves an inescapable element of relinquishment – a voluntary letting-go of a particular aspect of the fullest possible expression of the divine life in its living act (TD2:287). Thus the Father in sharing his divinity can never be *for himself alone*, but is always himself *with and through* another; the Son in accept-

ing the Father's image, permits himself to be generated *by another*; the Spirit, in submerging his 'I' in the 'We' of this generative exchange between Father and Son, allows himself to be expropriated in their service. However the nature of divine freedom also means that paradoxically such self restriction is both apogeal for *freedom itself,* and also enables the fullest self-actualisation for each of *the hypostases* in their distinctive particularity. In other words the Father acquires himself as his nature, not *in himself* and *for* himself but in proceeding *out of himself* and in begetting, as Father, the Son (Bulgakov, 1933/2008:97-9). Thus love, as self-surrender, is an inextricable part of 'the bliss of absolute freedom' (TD2:257, Nicholls, 2000:72); and the restraint enabling this self-surrender is a necessary condition for the potential coming-to-be of both Otherness and relational connection.

There is however a second key element to the differentiation of Otherness within the Trinity and this once again involves tension, paradox and the exercise of restraint. As already noted, von Balthasar understands the operation of kenoticism in the temporal realm, revealed through the Creation and the Incarnation, as extensions of the primal kenosis at the heart of the immanent Trinity. This leads him to posit the existence of an 'absolute, infinite difference/distance', a radical otherness within the Trinitarian life which can then encompass all other possible differences (including sin) which emerge within Creation (TD4:343). He thus understands the hypostatic modes within the Trinity as being 'inexhaustibly transcendent to each other' whilst at the same time experiencing 'the most intimate penetration' with each other (TD2:258). Indeed it is only on such a basis, as Williams points out (2004:42), that we can develop a theology which makes sense of a created freedom that is simultaneously both truly Other to God and yet orientated towards God. However this leaves us with a further paradox to unravel since this infinite difference between Father and Son necessarily entails an infinite mutual freedom in which the Father does not determine the Son and vice versa; but this then seems to lead to an irresolvable clash with the intimate exchange and connection which establishes the differentiated identities within the Trinity.

Once again kenotic restraint plays an important role in holding together this apparent antinomy – this time by means of creating a hiatus in which penetration and transcendence, sameness and difference can co-exist, held in creative ten-

sion. Von Balthasar accounts for this in terms of the members of the Trinity making room for one another and the opening up of distances (though he uses a problematic language of hierarchical processions) which allow each member, whilst still enjoying the exchanges of mutual love, to also preserve their own personal distinctness in both the immanent and the economic Trinity. He envisages this occurring within the Trinity as an infinitesimal moment, not of time but of distinction, in which the Father *is* but the Son is *not* – though since the Father is eternally generating the Son, this has to be couched in less absolute terms of 'not *not*'(Tonstad, 2010:608, TD5:94-5). Williams suggests that we might read the German *Abstand* here as *difference* rather then *distance* (Williams, 2004:41).

This is somewhat difficult to grasp but Derrida's unravelling of Husserl's 'im selben Augenblick[17]' is helpful here: for Derrida auto-affection (acting on oneself) – for example when one speaks of oneself or regards oneself in the mirror – is also inescapably hetero-affection; thus self is simultaneously experienced as both self *and* other. But this also, and equally inevitably, necessitates a miniscule hiatus differentiating me from myself which allows me to be both the speaker and the spoken, the looker and the seen: 'I see myself, and yet the self I see is not me' (Derrida, 1973:60-9). Thus it is possible to say of the Son that 'insofar as [he] is God, he is eternal, infinite freedom; insofar as he is the Son of the Father, he is this freedom in the mode of readiness, receptivity, obedience and hence of appropriate response' (TD2:267) – the two are the same and yet different. Moreover, it becomes possible to see how the Father, whilst eternally generating the Son can also, through a further movement of restraint, open a space in which the Son can be who he is without being subsumed back into the Father; and that in this free being-who-he-is, and in freely accepting the necessary freedom for its happening, the Son in turn gives infinite space to the Father to be who *he* is (Williams, 2004:41).

What we have then is a situation in which infinite freedom (and thus the restraint which is an inescapable aspect of it) is simultaneously operating in different dimensions: the hypostases are divinely free in that each possesses, in its own unique way, the divine essence as lived act. But each of the persons is *in themselves* also sovereignly free – that is they are 'let-be to be' – whilst at the same

[17] 'At the same moment.'

time, their freedom is co-determined by their interrelationships and the unity of their substantial life through these (Nicholls, 2000:72). Trinitarian freedom thus has a metric which is both is both active *and* receptive: it bestows *and* accepts life and identity; and as part of this it lets-be and accepts being-let-be. In other words, there is an intimate and complex relationship between freedom, restraint and Othering: for the coming-into-being of true otherness, space for differentiation is a *sine qua non*; and the making and preserving of such space requires the exercise of constraint – the use of freedom to limit freedom. Ultimately then, such freedom involves a two-fold negation: a refusal 'to be for oneself alone' and a refusal to look for the ground of ones being in 'an individuality divorced from relation' (Williams, 2004:42).

It is this 'primal kenosis' of the Trinity which 'makes possible all other kenotic movements of God into the world, they are simply its consequences' (TD4:331). To return to Bulgakov's conception of Divine life in terms of living act – Creation and Incarnation are extensions in time of the this eternal activity of self-giving love lying at the heart of the Trinitarian life (von Balthasar, 1990:35, GL7:213-4, TD2:264). Hence in both instances, restraint is an essential element in the differentiation and development of Otherness and in the establishing and maintenance of relational connection. Whilst the incarnational extension will be taken up again in Chapter 6; that of Creation provides a useful alternative vignette for succinctly summarising the key points here: for Creation to exist and not be subsumed back into God, there must be a space where God 'is not'; thus 'God Himself and in His proper life accepts sacrificial self-limitation in the name of love for Creation while preserving the entire fullness of His immanent being' (Bulgakov, 1933/2008:223). Similarly for there to be meaningful exercise of finite freedom, there must be a space between this and the Divine freedom which gives it, in which it can be used and exercised as human self-expression wills – its 'autonomous motion'. Thus again there is the necessity for a degree of divine withdrawal (TD2:273). There are strong resonances here with the 13th century Jewish kabbalists of the Iyyun Circle and their images of God holding his breath as a necessary prequel to the creative process (Laenen, 2001:106-110, 168); similarly with the 16th century Lurianic idea of *tzimtzum* – the self contraction of the *Ayn Sof* (Absolute) in order to create *tehiru,* the primordial space within which Creation could then exist and become aware of God. The presence of such parallels in other religious frameworks is fur-

ther testament to the rational generation and explanatory power of kenotic understandings.

Kenotic theology thus contributes some suggestive points with regard to the role of restraint in the generation of relational connection – the second of the designated cardinal signs being considered in this chapter. Von Balthasar's starting point is a specific religious perspective of the world, and his ultimate aim the development of a corresponding specifically theological understanding of the same; however his explorations of the themes of freedom, Otherness and connection generate insights which are not inextricably tied to such a view but can be more widely appropriated without requiring a concomitant assent to specific elements of its framework – such as for example the notion that the drama of Christ 'becomes the norm of every real and possible drama in the personal and public domains' (TD2:83). Both otherness and freedom are necessary conditions for a genuine relational connection to occur. What von Balthasar's rationally constructed, meticulous, and detailed explorations of the topic yields is the important insight that the exercise of restraint is a critical factor in various key aspects of this dynamic. It creates the space in which differentiation between self and other can occur and be preserved and in which the other can develop. It also gives the other the freedom to accept or reject connection and the mutual shaping which goes with it. Moreover such self-restraint is, paradoxically, the route to fullest self-expression of personhood – individuality reaches its expressional apogee when it restricts itself in order to create relational connection. We are thus brought to another dimension of Tillich's observation that 'when individualisation reaches the perfect form which we call a person, participation reaches the perfect form which we call communion' (Tillich, 1951:176).

There are interesting resonances here with the expansion of system possibilities through reduction of component freedom, or the separation of self and other crucial to MNS activity and successful ToM skills, discussed earlier. But while this suggests the possibility of useful interdisciplinary transversal development, the aim here is to use this theological contribution as the second of three interlocking pieces of evidence supporting a transversal case for relationality as an emergent phenomenon. The final piece of evidence – indications of possible downward causation – comes from the perspective of PNI.

5.5 Whole-Part influence: a PNI perspective

As discussed in 5.2.1 and 5.2.2**,** much of the controversy attending the claim of causal efficacy for emergents dissipates when it is considered within frameworks appropriate to the nature of complex systems and shaped by the current understandings of quantum physics. In particular, it can be canvassed, not in terms of the application of Newtonian linear forces, but in those of whole-part constraint on the behaviour of system components. The key question to be considered in this section is thus whether there is any evidence to suggest that relationality directly modifies any of the components of the system which support social signalling and interaction. Here, rather than introducing new data, I want to appeal to those already presented in section 5 of Chapter 3. What follows is thus simply a very brief reprise of the key salient points of these data as they touch on the possible issue of downward causality. Since the marital studies alluded to specifically examine alterations in endocrine and immune status as a function of relationship quality, fuller discussion of these will be deferred until Chapter 6 which considers the potential effects of variations in how relationality is realised.

The immune and neuroendocrine systems are intimately and bi-directionally connected via a complex interplay of hormones and the cytokine signalling system, with both systems sharing common receptors for these (Turnbull and Rivier, 1999:2-5). This combined activity serves two key purposes: firstly the provision of a constant surveillance system to monitor both internal and external environments for threats, and initiate appropriate responses to these; and secondly the facilitation and co-ordination of physiological processes serving allostasis, thus ensuring the optimisation of cellular and organ function needed to maintain stability through environmental change, at the smallest overall cost to the organism (McEwen and Wingfield, 2003:3; Sterling, 2004:26). If relationality constitutes an emergent arising from a complex system involving a range of basic social signal decoding neural nets, and associated physiological surveillance, signalling and response loops, then arguably its realisation has the potential to constrain the various components of this system.

In Chapter 3 I argued that despite some methodological caveats, PNI data suggest that interpersonal relationships can exert a range of effects on the immune/endocrine network, producing both up- and down-regulation of the two systems. Over a wide range of studies, close and supportive relationships consis-

tently correlate with lower levels of stress hormones and stronger immune responses. In contrast, social isolation and negative or acrimonious relationships are consistently associated with raised levels of stress hormones, poorer immune function and higher morbidity. Endocrine effects principally involve moderations of the hypothalamo-pituitary-adrenal (HPA) axis – which plays a vital role in allostatic maintenance – but also involve the oxytocin system, which operates in parallel with stress response systems to inhibit HPA activity after stress (Uvnas-Moberg, 1997:38-42; 1998:819-35). Immune system effects involve alterations to activity within both innate and acquired arms of the system. Of note are alterations in the levels and activity of certain key cytokines known to be involved in chronic inflammatory processes – something I will return to in chapter 6 when discussing possible physiological pathways mediating health outcomes.

Since adult romantic relationships constitute a primary locus of human social and attachment bonds, the subset of PNI studies involving couples are of particular interest here. Due to issues with recruiting appropriate subjects however, the number of such studies is relatively small within the overall PNI corpus. Dyads studied involve married (both new and longstanding) and recently separated and divorced couples, and have involved assorted indicators of both endocrine and immune activity (Dopp *et al.*, 2000:10-26; Gouin *et al.*, 2010:1082-90; 2009:898-904; Graham *et al.*, 2009:621; Heffner *et al.*, 2006:317-25; Kiecolt-Glaser *et al.*, 2003a:176-88; Kiecolt-Glaser *et al.*, 1987:13-34; 1997:339-48; Kiecolt-Glaser *et al.*, 1988:213-29; 2005:1377-84; 1993:395-42; Kiecolt-Glaser *et al.*, 1996b:324-32; 2001:472; Loving *et al.*, 2004:595-612; Malarkey *et al.*, 1994:41-51; Mayne *et al.*, 1997:277-88; Miller *et al.*, 1999:262-71; Robles *et al.*, 2006:305-25). The studies themselves will be discussed in Chapter 6 but for the purposes of this chapter, their findings can be generally summarised as confirming the links demonstrated within the wider corpus *viz.* that functional differences in relational connection between partners are reflected in both endocrine and immune systems. These studies are deemed to represent 'some of the most compelling PNI data to date' on social influenced changes in both innate and adaptive immune markers (Robles and Kane, 2012:199, 207).The underlying pathways and mechanisms linking social status to PNI alterations are as yet unspecified, but are likely to be multiple and to operate additively, or even perhaps synergistically. I will return to the issue of potential mediators in Chapter 6. For the moment I want simply to suggest that the

link between the two can coherently be understood as a whole-part restraint scenario, in which relational experience moderates immune and endocrine components of the complex integrated system from which relationality emerges.

5.6 Relationality as emergent: a transversal outcome

In the previous chapter, scientific and theological perspectives on relational connection were used transversally to build a mutually supportive case for claiming such links as basic to humanness. The current focus has been on whether relationality represents an emergent *from* rather than simply a summation *of* certain innate decoding skills. In order to support this contention it is necessary to demonstrate that relationality exhibits the characteristic features of such phenomena: a base in complex systems operations and the presence of top-down causal efficacy, operating through whole-part restraint mechanisms. In view of the difficulty of doing this within the bounds of a single discipline, an alternative, transversal, approach has been pursued. In this, evidence for each of these characteristics has been sought from a different disciplinary perspective using the tools and epistemic standards of the postfoundational rubric set out in Chapter 2**.** The transversal outcome to be carried forward is thus constructed through a slightly different instantiation of Haack's crossword analogy. In this instance, each disciplinary voice does not primarily act as an interlocking support for the evidence of another on a specific point – although some obvious resonances indicate that with a differently constructed transversal space exchange, this could also be done. Instead, each offers a single and distinct piece of evidence to the building of a composite transversal argument that relationality is an emergent phenomenon.

Examination of experimental data from various branches of cognitive neuroscience suggests the presence of a nested set of complex systems underpinning each individual decoding. Furthermore the appearance of non-innately specified skills such as those involved in ToM processing indicates that complexification of these processes also occurs in tandem with brain development. Since self-organising complex systems, as well as being novel units in their own right, also have the capacity to interact with other such systems and processes expressing themselves at the same scale, this too can be taken as highly suggestive of complex system function. Such interactions then become the building block for new iterations at a larger scale of the complex system dynamic cycle of non-trivial interactions, devel-

opment of system restraints, symmetry breaking and the appearance of global coordination and associated new patterns and behaviours (Prokopenko *et al.*, 2009:1-2). One can thus see how a capacity to form and maintain relational connection, which is more than merely summative, might emerge from the organisation and interaction of individual decoding processes.

With respect to the nature of emergent causality, the key dynamic is one of component restraint which opens an extended range of possibilities to the system as a whole. Insights generated through the explorations of kenotic trinitarianism suggest that the operation of restraint is a key element in the exercise of relationality. Genuine relational connection requires both otherness and freedom as its *condiciones sine quibus non.* Otherness in turn necessitates a hiatus – a space in which differentiation can occur and the development of distinctive, separate identity be established. The exercise of self restraint enables the generation and preservation of this necessary space in which the development of the distinctive, separate identity of the other can be established and their autonomy exercised. Such restriction simultaneously confers a two-fold expansion: it enables the possibility of relational connection and, paradoxically, it allows individuality to reach its expressional apogee through that possibility.

Emergent causality also acts in a characteristic, and from classical Aristotelian and Newtonian perspectives paradoxical, top-down direction. Alongside ones looking specifically at intimate primary relationships, a whole range of PNI studies have investigated variations in endocrine and immune markers in conjunction with assorted different quantitative and qualitative measures of social connection. Across these studies, variations in numerical and functional measures of relational connection consistently correlate with variations in HPA axis reactivity, rapidity and height of acute immune responses, and the strength and efficiency of adaptive ones. Although precise mechanisms have not been elucidated and are almost certainly multiple, these results (particularly those from assorted 'marital' studies) are strongly suggestive of a scenario in which higher level global function affects component parts of the systems which support it – i.e. of the causal signature of an emergent phenomenon.

Data from experimental CGN and PNI studies, and theological reflection on relationality can thus be combined to provide transversal evidence supporting the

contention that relationality displays the requisite features to be designated as an emergent rather than a summative phenomenon. This brings in its train the possibility that moderations effected by the *experience* and *expression* of relationality might constitute one possible physiological pathway whereby the connection between social relationships and health outcomes discussed in Chapter 3 could be mediated. The final piece of the puzzle is thus to look at whether there is any evidence that the different shapes in which relationality can be realised can significantly effect aspects of human functioning. This will be the subject matter of Chapter 6.

Hostility or Hospitality?

Relationality as realised

> We are more entangled, but less attached, than ever before.
>
> (Sandel, 2005:172)

> There can be no authentic depth except where there can be real communion; but there will never be any real communion between individuals centred on themselves […] the very notion of intersubjectivity presupposes a reciprocal openness between individuals.
>
> (Marcel, 1967a:267)

> My looking ripens things
> and they come toward me, to meet and be met.
>
> Rilke (Book of Hours I, i)

6.1 Introduction and outline

In the thirty-four years since publication of Berkman and Syme's seminal study (1979:186-204), the correlation between social support and levels of morbidity and mortality has been consistently and reliably demonstrated over many other studies. But whilst the connection has been convincingly confirmed, and though the influence exerted is comparable with other well established risk factors for mortality (Holt-Lunstad *et al.*, 2010:12), the nature of the link is less clear, and the underlying mechanisms remain almost completely opaque (Cohen and Janicki-Deverts, 2009:377). The picture is further complicated by the fact that social support is not an undifferentiated monolith but comprises, as indicated in Chapter 3**,** distinctly different structural and functional elements. Pathways linking social connection and health are thus likely to be multiple, and potentially could act in summative or even synergistic fashions. Their elucidation, along with those of the mechanisms underpinning them, is seen as the primary research objective for 'second-wave' PNI studies (Uchino *et al.*, 2012:220).

Uchino (2006:378-9; Uchino *et al.*, 2012:220-5) has recently developed a broad theoretical model highlighting the routes by which social support might influence

physical health outcomes. Essentially this postulates two distinct pathways: the first is a behavioural route involving elements such as general health behaviours and adherence to treatment regimes etc. Although known to be predictive of mortality in their own right, studies suggest that even when such things are taken into account, it does not explain without remainder the observed link between social support and health (Holt-Lunstad *et al.*, 2010). Thus a second, psychological pathway is also proposed involving appraisals, emotions, moods, feelings of control etc. Behavioural and psychological routes are each thought to be influenced, in different ways, by both structural and functional aspects of social support, and also to act on each other; and both are deemed to exert their ultimate effects on morbidity and mortality through the common broad biological pathway of the endocrine and immune systems, which as previously noted, are also intimately and reciprocally linked. The resulting web of complex multidirectional influence and effect can be visualised thus:

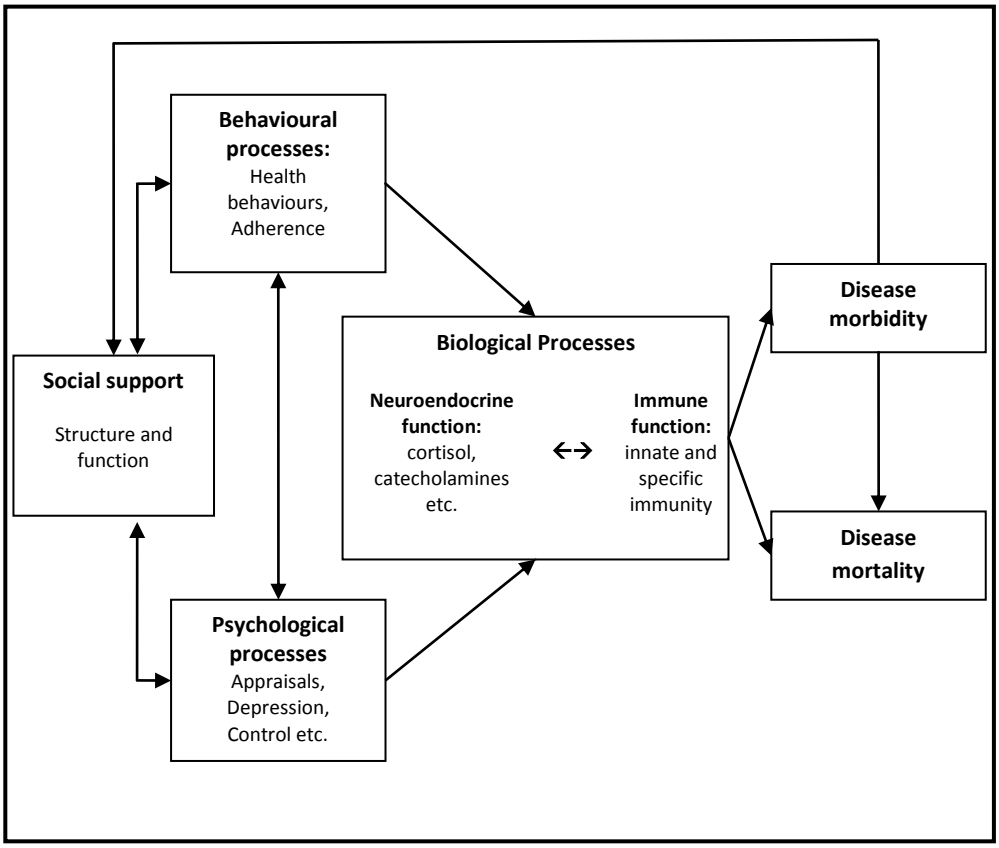

Figure 1: A broad model highlighting the major pathways by which social support may influence physical health outcomes (after Uchino *et al.*, 2012:220)

There are two additional aspects of the dynamic of connection which the model does not directly represent but which must also be born in mind and which again

were highlighted in Chapter 3*:* firstly the *location* of the main protective effect – i.e. whether social support works primarily by ameliorating stress/raising the threshold at which given events are perceived as stressful (thus reducing the initial extent of excitation of physiological responses from without); or whether the functional response of endocrine and immune systems to CNS excitation are directly moderated in some way by the experience of social connection (thus altering response from within). Secondly, there is the *timing* of the protective effect. Here the question is whether moderation occurs primarily in direct connection with stressful events themselves (the 'stress-buffering' model), or whether it occurs independently of the level of stress (the 'main effect' model). Finally, there is also the fact that for each individual, their understandings about, development and utilisation of, and hence the relative effectiveness of the social support they experience, varies across their lifetime. Thus adopting a life-span perspective may also be a crucial factor in understanding the pathways involved (Uchino, 2009:236-55).

However while there is a robust literature linking both perceived social support to psychological outcomes such as lower levels of stress/depression/loneliness or increased life satisfaction (Barrera, 2000:215-45; Wills and Shinar, 2000:86-135), and psychological factors such as these to immune function (Segerstrom and Miller, 2004:601-30), assorted epidemiological and experimental studies have provided little direct information on the pathways linking up this triangular relationship (Loucks *et al.*, 2006b; Uchino *et al.*, 2012:222). The hitherto almost exclusive focus on documenting the link rather than investigating its mechanisms, gives some indication of the complexity of the task. One of the aims of this project has been to explore whether a transversal approach, which brings together data from a range of disciplines in a distinctly different way, might be one possible approach to it. The focus of interest is in the possibility of a more direct physiological pathway by which social connection might moderate immune function, primarily as a main effect phenomenon. The hypothesis being advanced is that relationality (that is the capacity to form and sustain relationships) is an emergent phenomenon arising from a complex system supporting social signal surveillance, decoding, and response, and can thus exert direct causal influence on components of that system, including its endocrine and immune signalling elements. In effect this would constitute an additional pathway to Uchino's basic model which connects

'social support' directly to 'biological processes' without routing it through either the 'behavioural' or 'psychological' staging posts. In so doing, it also follows through on an observation made by House in his original paper that social support

> may have directly motivational, emotional or neuroendocrine effects that promote health either directly or in the face of stress or other hazards but **that operate independently of cognitive appraisals or behavioural coping** (House *et al.*, 1988:543-4, emphasis mine).

Earlier chapters have built an argument for considering relationality as an emergent phenomenon of social monitoring systems and thus capable of exerting top-down constraint on immune and endocrine components of these. If this is so, then the *shape* in which relationality is realised may affect the nature or location of that constraint, thus providing a possible route for variations in the quality of social relationships to directly affect physiological mechanisms relevant to health. The final transversal space engagement therefore explores whether, how, and why relational shape might effect functioning. On this occasion, the contributions will come primarily from PNI and theology.

The following section looks at experimental evidence linking the shape of relationality to alterations in the systems which support it. There are a number of studies looking at differential brain activation in conjunction with experiences of social exclusion, previous relational experience, or degree of rejection sensitivity (e.g. Burklund *et al.*, 2007-53; Cacioppo *et al.*, 2009:83-92; Eisenberger *et al.*, 2003:290-2; Masten *et al.*, 2012:106-114). However, in line with the primary interest in physiological connection pathways, the focus here is on PNI data. Studies looking at correlations between immune or endocrine markers and marital quality (both as self-reported and in the context of laboratory induced stress) demonstrate a high degree of heterogeneity in both design and findings. This is in part due to the general issues with PNI studies outlined in Chapter 3, and in part to the complexity of the connections under study. Whilst this leads to some discrepancies between individual studies, and to the apparent evaporation of some associations at the level of meta-analysis (Robles *et al.*, In press:46-7, 53), some broad conclusions can be drawn and a summary of these is presented with particular attention to the issue of disruptions to inflammatory signalling.

The articulating voice then passes to theology for a consideration of how the dispositions towards relational connection affect how it is shaped and experienced,

and here I draw on the thinking of Gabriel Marcel. Once again, in keeping with the post-foundational epistemic contract set out for the project, I begin by discussing why Marcel's approach to investigation, like that of both the Cappadocians and von Balthasar (though for somewhat different reasons), not only seems eminently suited to transversal work, but also offers a way of addressing a particular problem involved in the exploration of relational connection. I then consider his notions of *disponibilité* and hospitality, linking these to ideas discussed in earlier chapters to present a theological contribution to informing transversal understanding about the significance and potential effects of relational shape.

With this last piece in place, the final section draws together and rehearses the thesis arguments. It then uses these to derive a theoretical transversal model for an additional pathway linking relationality and health, operating within the framework of allostatic maintenance. Finally I return to the definitions of health which were laid out in Chapter 3, to suggest that in the model proposed, biomedicine's 'disruption of the mechanics' and Marcum's 'distortion of the life world' are intimately and inextricably entwined.

6.2 Embrace or exclusion: a PNI perspective

Links between marriage and health have been a subject of empirical research for over half a century. As a key social relationship, marriage provides a vital source of emotional, psychological, and practical support and those who are separated or divorced experience more acute illness and initiate more physician interactions than their married counterparts (Somers, 1979:1818-22). In comparison to them they also have significantly higher risks of major depression (Weissman, 1987:445-51) and of earlier death (Sbarra *et al.*, 2011:454-74). However marriage can also be a significant locus of conflict and stress, and assorted studies have provided 'compelling evidence' (Slatcher, 2010:458) linking marital *quality* to various aspects of health and illness, with alterations in the former also appearing to map onto changes in the latter in some of these (Wickrama *et al.*, 1997:143-55). Lower quality, as measured by various criteria, has been correlated with increased risk of mortality (Eaker *et al.*, 2007:509-13), obesity (Kouvonen *et al.*, 2011:1474-80), periodontal disease (Marcenes and Sheiham, 1996:357-69), cardiovascular disease (De Vogli *et al.*, 2007:1951-7), coronary artery events (Orth-Gomér *et al.*, 2000:3008-14), higher ambulatory blood pressure (Holt-Lunstad *et al.*, 2008:239-

44), faster progression of atherosclerosis (Gallo *et al.*, 2003:953-62), poorer diabetic control (Trief *et al.*, 2006:318-31) and increased pain flare ups in rheumatoid arthritis (Zautra *et al.*, 1998:271-9). It is also predictive of preclinical signs of coronary heart disease (Smith *et al.*, 2007:441-8), length of hospitalisation after coronary bypass operations (Kulik and Mahler, 2006:2031-40), and earlier death in chronic medical conditions (Coyne *et al.*, 2001:526-9; Kimmel *et al.*, 2000:1518-25; Rohrbaugh *et al.*, 2006:1069-72).

But whilst the available investigative tools have, like the institution itself, undergone dramatic transformations, the precise mechanisms underlying these connections still remain to be elucidated and once again multiple pathways and attenuating/potentiating interactions are likely. Studies of PNI function in the context of marital relationships thus offer a number of benefits from the perspective of the chapter exploration: firstly they target the physiological possibilities which are its prime interest; secondly they sharpen the focus down from the level of networks to that of specific significant relationships and finally, in so doing, also provide the opportunity to look much more directly at whether and how difference in relational shape affects elements of the systems which support relationality. Attention has already been drawn to the applicability of the general methodological caveats raised in Chapter 3 regarding operalisation, confounders, disaggregation, and extension when reading these data. Amongst these, two aspects which need to be particularly highlighted are the issue of potential alternative causalities and that of extrapolation to actual health outcomes from surrogate endpoints. With the former, causal factors other than marital discord may be active but unperceived influences on commonly measured variables such as cardiovascular reactivity thus distorting results (Nealey-Moore *et al.*, 2007:506). With the latter, only two studies to date (Gouin *et al.*, 2010:1082-90; Kiecolt-Glaser *et al.*, 2005:1377-84) have actually looked at marital quality, immediate physiological changes, and health effects (in this case, wound healing) simultaneously. Most studies look at either proxy end points such as BP or cholesterol levels or, as is increasingly the case, biomarkers. The former have usually been established as predictively related to clinical endpoints but the issue is much less clear cut with the latter (Robles *et al.*, In press:10). However a number of immune markers are known to be surrogates of CVS disease risk (Ridker *et al.*, 2004:6-19) and atherosclerotic progression (Libby and Theroux, 2005:3483) and, as previously discussed, an increasing body

of evidence points towards chronic inflammatory processes as being heavily implicated in the pathogenesis of a number of major disease groups. Nevertheless, questions as to precise mapping onto long term health outcomes and the underlying mechanics thereof still remain to be answered.

Despite these assorted practical and interpretational difficulties, these particular studies, though relatively small in number, are seen as providing some of the most compelling evidence to date of social influence on immune functioning (Robles and Kane, 2012:205). They have looked at aspects of endocrine function – typically related to HPA axis or sympathetic nervous system (SNS) function – and/or markers of both direct and adaptive immunity, in conjunction with assorted aspects of negative and supportive marital behaviour. Dyads studied have included newly weds, long-established partnerships, and newly separated and divorced couples, and studies have involved both naturalistic and laboratory settings. In the latter scenario, centred on real-time interactions, studies typically take the form of basal measurement of assorted endocrine and immune markers, and then further samples over time in conjunction with a stressor – usually a specified interactive task involving either conflict resolution (for example discussing marital disagreements) or supportive discussions. Interactions are videoed and assessed and coded for the presence of hostile or negative behaviours such as criticism, negative attributions regarding spousal behaviour, interrupting etc. Some studies also include self-reported measurements of marital quality or hostility. Given the bidirectional complexity of immune and endocrine feedback and function, it is highly likely that different effects investigated are entrained to each other in some degree. However for the purposes of this section results from studies will be disaggregated and summarised in three separate categories – endocrine, innate and adaptive immunity, and local and systemic inflammatory effects.

6.2.1 Alterations in HPA and SNS activation

PNI endocrine studies across the corpus have traditionally focussed on SNS and HPA functioning – the classical indicators of initial allostatic response The prototypical pathways by which these have been studied have been the measurement of circulating catecholamines[18] and level of cardiovascular reactivity (CVSR) for the

[18] The hormones dopamine, norepinephrine (noradrenalin), and epinephrine (adrenalin) which are released from the adrenals in response to SNS stimulation.

former, and changes in diurnal cortisol[19] secretion in the latter. Catecholamines and glucocorticoids have wide ranging effects which are important in allostatic maintenance – something to which I will return in section 4. In addition, some recent PNI couples studies have also started to examine levels of vasopressin/ADH and oxytocin[20] as another way of assessing HPA functioning. Across this range, studies show a correlation between aspects of marital interaction and alterations to all of these components.

With respect to effects of marital quality on SNS activity, 2 large studies have looked at changes in circulating catecholamines in response to problem solving and conflict tasks. In the first, involving newly married couples, while levels of reported marital satisfaction were high, more hostile or negative behaviour during conflict tasks was closely linked to higher levels of epinephrine and norepinephrine (Malarkey *et al.*, 1994:41-51). In the second, this time involving long-married couples (average length 42 years), lower levels of marital satisfaction and escalation of negative behaviour during a conflict task were correlated with raised catecholamine levels in wives but not husbands (Kiecolt-Glaser *et al.*, 1997:339-49). In an interesting and possibly suggestive ten year follow-up of the first group, couples who had subsequently separated or divorced were found, on review, to have shown significantly higher elevations of both basal and responsive catecholamines in the original study compared to those who had remained married. Couples who were still married but whose marriages were troubled, also had higher catecholamine levels at the earlier time. In contrast original levels of satisfaction had no predictive correlation with subsequent divorce or lower marital quality.

CVSR, as part of the fight or flight response, is another way of measuring levels of SNS activity. Across a wide variety of studies, both poorer marital quality (measured in a range of ways) and more hostile behaviour during discussion tasks have been correlated with increased CVSR (Barnett *et al.*, 2005:36-43; Ewart *et al.*, 1991:155-63; Kiecolt-Glaser *et al.*, 1993:395-412; Mayne *et al.*, 1997:277-88; Morell and Apple, 1990:387-402; Smith and Brown, 1991:581-92). Whether high relational quality plays a corresponding role in lessening reactivity is unclear with some studies showing no significant effect (Barnett *et al.*, 2005:36-43; Ewart *et*

[19] An important member of the glucocorticoid (steroid) hormones released from the adrenals under stimulation from the anterior pituitary hormone ACTH.
[20] Both released directly from the posterior pituitary.

al., 1991:155-63), whilst another showed a positive correlation to lower ambulatory blood pressure (BP) in a naturalistic setting (Holt-Lunstad *et al.*, 2008:239-44). With respect to the earlier noted caveat that other factors may influence CVS reactivity in unstructured tasks, one study has attempted to control for this by comparing positive, neutral, and negative interactions under conditions in which speaking and task involvement were precisely specified. In this, negative discussions evoked larger changes in five different measures of CVS reactivity compared to positive and neutral ones (Nealey-Moore *et al.*, 2007:509-19) thus supporting the contention that at least some of the changes observed in other task-based studies are due to the quality of exchange.

Turning to HPA function, various studies have examined alterations in cortisol response curves (one marker of changes in stress level) in relation to a number of measures of marital quality. Cortisol has a natural circadian rhythm, and thus as well as absolute levels, rates of change (as indicated by the gradient of the diurnal slope) are also an important measure of function, with shallower curves indicative of disruption to this. Stress is known to trigger cortisol release but the heterogeneity of the literature on psychological stress and HPA axis moderation suggests that negative situations do not uniformly do so (Dickerson and Kemeny, 2004:355-91). However a number of studies have shown a correlation between negative behaviour during interactive tasks and increased levels of cortisol (Heffner *et al.*, 2006:317-25; Kiecolt-Glaser *et al.*, 1996b:324-32). This appears to be particularly the case when there is either a perceived or actual behavioural pattern in which demand by one partner is followed by withdrawal of the other, although the studies produced conflicting evidence on the actual effects of the latter. In a number of other studies, lower marital quality has been consistently correlated with flattening of diurnal slopes and better quality with steeper declines (Adam and Gunnar, 2001:189-209; Barnett *et al.*, 2005:36-43; Ditzen *et al.*, 2008:883-89; Ditzen *et al.*, 2007:565-74; Robles *et al.*, 2006:305-25; Slatcher *et al.*, 2010:887-96). One study also linked supportiveness during highly negative interactions with steeper ACTH and cortisol declines in wives, suggesting that constructively engaging in discussions promotes adaptive physiological responses to interpersonal conflict (Saxbe *et al.*, 2008:15-25).

In contrast, couples with higher levels of intimacy show reduced cortisol levels in response to work related problems (Ditzen *et al.*, 2008), and women receiving positive physical partner contact (neck and shoulder massage) prior to stress tests subsequently exhibited significantly lower cortisol and heart rate responses to this (Ditzen *et al.*, 2007). A further study (involving newly weds) has also examined circulating levels of ACTH (which stimulates cortisol release) in conjunction with relative power within a relationship (as measured by comparing reports of dependant love for one another) In this, whilst conflict behaviours *per se* did not vary as a function of power, less powerful partners showed a rise in ACTH in response to conflict engagements, with actual cortisol levels also remaining elevated in less powerful wives (Loving *et al.*, 2004:595-612).

The final tranche of data involves the relationship between oxytocin and vasopressin levels and marital quality. These studies are slightly different in as much as they investigate a positive element of relational shape. Oxytocin is not only involved in relational bonding, but the oxytocin system operates in parallel with stress response systems to inhibit HPA activity after stress (Uvnas-Moberg, 1997:38-42; 1998:819-35) – thus it acts to return systems to their baseline state once a stressor has been resolved or removed. Moreover, in animal studies it has been shown to moderate pro-inflammatory cytokines and speed wound healing (Gouin *et al.*, 2010:1083). There are assorted indications that it plays an important role in relationships and better relational quality (including actual and perceived support) and increased physical contact (in the form of hugs) are both associated with higher circulating levels of oxytocin (Grewen *et al.*, 2005:531-8; Light *et al.*, 2005:5-21). The administration of oxytocin prior to conflict tasks has also been shown to increase positive communication behaviours (as compared to a placebo) and reduce cortisol levels post stressor(Ditzen *et al.*, 2009:728-31). Finally in a wound healing study, associations were demonstrated between high levels of oxytocin and more positive communication behaviours in a structured interaction, and between higher levels of vasopressin and fewer negative communication behaviours. Moreover those with high oxytocin levels also had faster blister-wound healing (Gouin *et al.*, 2010:1082-90).

6.2.2 Alterations to innate and acquired immunity

The immune system has both an innate and an adaptive arm and whilst the two are interrelated and influence each other, they are also different in key ways. The

former, which constitutes the first line defence against invasion and insult, is a non-specific response producing its maximal effect immediately and making no ultimate contribution to immune memory. The latter is a second line mechanism which is specific, involves a time lag between exposure and maximum response and contributes to developing immune memory. Although inflammatory processes are part of both of these responses, they will be considered separately.

Broadly speaking, marital studies show that poorer relational quality affects both the immunological response paths but in significantly different ways, leading to a short lived up-regulation of innate mechanisms, but a down-regulation of adaptive ones. In the case of the former, one of the major changes observed is in the dynamics of circulating natural killer cells (NKC) – a subset of lymphocytes which constitute a major component of the innate response system. Higher circulating numbers, increased levels of cytotoxic activity, and swifter rate of decline were noted across various studies, in connection with more hostile or negative behaviours. Thus couples with high negative behaviours had higher initial levels of cytotoxity and a greater decline at 24 hours after a conflict engagement (Kiecolt-Glaser *et al.*, 1993:395-412). Higher anger levels during interactions were associated with higher circulating numbers and greater NKC cytotoxity during and after an interactive task in men who also reported cynical hostility (Dopp *et al.*, 2000:10-26; Miller *et al.*, 1999:262-71). These NKC changes mirror those seen in response to acute stressors (Segerstrom and Miller, 2004:607) but are shorter lived. The other significant effect on innate immune responses involves alterations in local and systemic cytokine activity. This will be discussed in the following section dealing with wound healing and inflammation.

With respect to adaptive immunity, there are once again strong indications of a correlation between relational shape and immune functioning, with lower marital quality consistently associated with poorer adaptive responses as demonstrated by a number of different enumerative and functional measurements. In terms of circulating system components, couples showing high levels of negative behaviour also had changes in both numbers and relative ratios of key circulating cells related to adaptive immunity (Kiecolt-Glaser *et al.*, 1988:213-29; Kiecolt-Glaser *et al.*, 1993:395-412). Significant alterations were also seen in three functional measures: firstly in couples who displayed high-negative behaviour in conflict

tasks, lymphocytes (a major cellular component of the adaptive arm) showed poorer proliferative and blastogenic responses to various challenges (Kiecolt-Glaser *et al.*, 1987:13-34; Kiecolt-Glaser *et al.*, 1997:339-49; Kiecolt-Glaser *et al.*, 1993:395-412); moreover larger increases in hostile mood during the task was directly mirrored by larger decreases in the proliferative response (Mayne *et al.*, 1997:277-88). Secondly, both newly wed and older couples with greater hostility ratings raised higher levels of titres against Epstein Barr Virus (EBV), indicating poorer adaptive cellular control of the latent virus (Kiecolt-Glaser *et al.*, 1987:13-34; Kiecolt-Glaser *et al.*, 1997:339-49; Kiecolt-Glaser *et al.*, 1988:213-29; Kiecolt-Glaser *et al.*, 1993:395-412). Finally, a number of studies – involving both spousal dementia care givers (Kiecolt-Glaser *et al.*, 1996a:3043-7; Vedhara *et al.*, 1999:627-31) and couples reporting low marital satisfaction (Phillips *et al.*, 2006:279-89) – have linked diminished marital quality to impaired responses to influenza vaccine.

Essentially then, poor quality of marital relationship correlates with changes to both innate and adaptive immune function which mirror patterns shown in chronic stress situations (see Segerstrom and Miller, 2004:601-30 for an overview of these). Once again it is not clear to what extent gender has a moderating effect on these. Some studies found none for the innate system changes (Gouin *et al.*, 2009:898-904; Kiecolt-Glaser *et al.*, 2005:1377-84) whereas others recorded larger effects for men than women (Graham *et al.*, 2009:621-; Miller *et al.*, 1999:262-71). A similar heterogeneity is seen with adaptive function studies which vary from showing no difference between the sexes (Kiecolt-Glaser *et al.*, 1997:339-49) to larger reported effects for both women (Kiecolt-Glaser *et al.*, 1993:395-412) and men (Mayne *et al.*, 1997:277-88). Thus there is not a clear match with the larger epidemiological patterns for marriage and health which show men deriving greater benefit from marriage in health terms. However this probably reflects issues such as small sample size, and the very different time scales between PNI and epidemiological studies (Robles and Kane, 2012:205).

6.2.3 Correlations with local and systemic inflammatory markers

Innate and adaptive responses also both have inflammatory components. But whilst inflammation is a key part of the body's defence arsenal, chronic inflammatory processes are also increasingly implicated in the pathogenesis of major dis-

eases. Thus anything disrupting the regulation of inflammatory mechanisms may have significance for health outcomes. There are fewer studies looking at local and inflammatory markers, and various additional methodological difficulties have to be surmounted in these, for example the sensitivity of key markers such as IL-6 to a variety of confounders which are harder to regulate (e.g. diet and activity), or the fact that levels rise much more slowly in response to laboratory stressors than those of cortisol and the catecholamines (Kiecolt-Glaser *et al.*, 2010:36-7). Nevertheless studies have yielded some suggestive information about correlations between these markers and relational shape.

Indications of changes in local inflammatory response come from two studies involving the administration of controlled skin insults in the form of suction blisters.[21] That wound healing is affected by psychological factors is amongst the most well documented of PNI effects (Walburn *et al.*, 2009:253-71). Successful repair requires progress through a number of inflammatory stages and pro-inflammatory cytokines play a vital role in initiating and maintaining the critical cascades required for these (Gouin and Kiecolt-Glaser, 2011:86). Thus alterations in local expression of cytokines can moderate the timescale of the healing process. Both studies examined whether aspects of marital interaction altered the rate of wound healing, the first by comparing wound repair following both a conflict and a support task (Kiecolt-Glaser *et al.*, 2005:1377-84) and the second by correlating wound healing against different behaviour patterns displayed during a supportive interaction (Gouin *et al.*, 2010:1082-90). Rates of wound healing, local and systemic cytokine levels and systemic hormone levels were the different variables measured. The latter have already been discussed in the endocrine section.

In couples doing the dual interaction, blister wounds administered prior to the conflict task healed more slowly than those given before the support task. Moreover the rate of healing also showed a correlation with the quality of the discussion itself: couples displaying more negative and hostile behaviours showed a slower rate of healing in both the conflict and support scenarios than those whose interactions were less negative. These differences were substantial with couples displaying high hostility having a healing rate 40% slower than that of low hostile couples (Kiecolt-Glaser *et al.*, 2005:1377-84). Similarly in the study monitoring

[21] A third, much earlier study (Kiecolt-Glaser *et al.*, 1995:1194-6) involving dementia caregivers will be considered below in conjunction with other dementia studies.

different behaviour patterns, those couples who displayed more positive communication patterns – increased self-disclosure, acceptance of their partner, relationship-enhancing statements, and humour – during the structured interaction task had faster rates of wound healing, particularly the women (Gouin *et al.*, 2010:1082-90). Production of the three measured pro-inflammatory cytokines (IL-6, IL-1β, and TNF-α) at the wound site also paralleled the impact of conflict on wound healing: the rate of rise (an indicator of the briskness of the local immune response) was less steep following the conflict task than the support one, and couples who demonstrated high-hostile behaviour also had lower local levels of TNF-α. Moreover for both tasks, high-hostility subjects had significantly fewer inflammatory cells in the blister chamber fluid than low-hostile subjects, again indicating a reduced local response (Kiecolt-Glaser *et al.*, 2005:1881).

Serum levels of pro-inflammatory cytokines (i.e. measurement at the systemic level) did not however correlate with these local patterns, and indeed showed an opposite relationship. Here though a critical factor to be borne in mind is the complex and pleiotropic nature of the cytokine system, one of the results of which is differences in production route and biological significance of particular molecules at local and systemic levels. This leads to the apparently paradoxical situation in which circulating levels of pro-inflammatory cytokines can be elevated, but tissue levels of the same cytokine depressed i.e. there is a simultaneous up-regulation of inflammatory processes at system level and a down regulation at cellular level (e.g. at a wound site) – something I will return to later in the chapter. Once again there was a marked difference between couples exhibiting low and high hostile behaviours. The latter had relatively greater increases in plasma levels of both IL-6, and TNF-α following the conflict than the support discussion: in contrast to those with low-hostile patterns who produced approximately the same incremental rise in IL-6 over the twenty-four hours following both tasks, their IL-6 production was almost two and a half times higher (Kiecolt-Glaser *et al.*, 2005:1382).

Further studies on the same sample population found higher levels of circulating IL-6 between conflict and support tasks in individuals who were (self-reportedly) less comfortable with personal intimacy and wished to avoid partner dependence (Gouin *et al.*, 2009:898-904); and that the use, during conflict tasks, or words indi-

cating causal reasoning and insight, was correlated with lower circulating levels of IL-6 and TNF-α, an effect that was heightened for husbands when their wives also used such words (Graham *et al.*, 2009:621-30). Both of these suggest that differences in aspects of the quality of relational experience are also mirrored physiologically in cytokine activity.

Some corroborative evidence for these associations between relational quality and cytokine levels can be adduced from other more general studies of differences in marital or other social connection related to circulating inflammatory markers: for example IL-6 levels have been inversely correlated with the level of partner support in young women (Whisman and Sbarra, 2012:290-5), poor social relations in older women (Friedman *et al.*, 2005:18757–62), and the strength of social networks in men (Loucks *et al.*, 2006b:835-42). Similarly elevated levels of C-Reactive protein (another important marker of systemic inflammation) are associated with poorer integration into social networks in men (Ford *et al.*, 2006:78-84; Loucks *et al.*, 2006a:1010-16). It is worth recalling here that that higher levels of IL-6 and CRP correlate with increased mortality in healthy older populations (Harris *et al.*, 1999:506-12).

A final set of data come from the very different perspective of the spousal care in dementia studies. Whilst these are usually presented in the context of studies of chronic stress, a situation where a relationship which was previously a main source of interpersonal support has become instead a primary and escalating source of stress and distress can arguably also give some pointers towards the physiological effects of altered relational shape. Tellingly perhaps in this respect, care-givers still tend to number their dementia-suffering partners amongst their close support network, whilst also reporting fewer important personal relationships than controls (Kiecolt-Glaser *et al.*, 1991:352, 358). In the key longitudinal controlled study (Kiecolt-Glaser *et al.*, 2003b:9090-5), levels of serum IL-6 were monitored over six years in 119 people who were (or had recently been) caring for a spouse with dementia, and 106 non care-giving controls. At the point of entry, 28 of the care-givers' spouses had already died, and an additional 50 died during the study. Levels of circulating IL-6 are known to rise with age, but the average rate of increase in care-givers was four times as large as that of non care-givers. Moreover, bereaved care-givers continued to exhibit the same steeper incre-

mental slopes as current caregivers even several years after spousal death. These patterns were not accounted for by differences in health, medication, or health behaviours between the care-giving group and the controls and thus arguably suggest a correlation to some aspect of the relational experience itself.

Two much earlier studies of dementia care-giving also contribute some suggestive collateral data linking relational experience to dysregulation of inflammatory functions at local and systemic level. Firstly, a small study of women caring for dependants with dementia (mothers and husbands), showed two indications of impaired local inflammation compared to matched controls: a significant delay in the healing of punch biopsies, with wounds taking an average of nine days (24%) longer to resolve; and a significantly lower challenge-induced output of mRNA[22] for interleukin-1β (an important cytokine in local inflammatory cascades) by blood leukocytes harvested prior to biopsy (Kiecolt-Glaser *et al.*, 1995:1194-6). Secondly, in the care-giver study already referenced in connection with impaired acquired immunity (Kiecolt-Glaser *et al.*, 1991:345-62), another associated finding was that care-givers had a much greater incidence of depressive disorders than controls: 25% met diagnostic criteria at entry (compared with 0% of controls) rising to 32% (and 6%) at 13 month follow-up. Whilst this early study did not measure serum inflammatory markers, there is now, as already noted, increasing evidence that systemic inflammation is implicated in depressive disorders (Miller *et al.*, 2009:732-41), hence these higher incidences of depression might well be an indication of inflammatory dysregulation in the care giving group.

Although I have considered these effects separately, this is clearly something of an artificial disjunction given the complex interrelationship between brain, endocrine, and immune systems, and they are likely to be cross-related in web-like ways. While these particular studies have not explicitly explored how the measured changes in various different system elements might be connected, assorted evidence from other human and animal studies point towards possible connecting threads. Thus for example women with higher CVSR have also been shown to have higher EBV titres compared to women with low reactivity (Cacioppo *et al* 2002). With respect to aspects of acute response, one of the earliest recognised effects of glucocorticoids was the regulation of circulating leukocyte subset com-

[22] Messenger RNA - an indication of production potential.

position, with high glucocorticoid levels leading to neutrophilia and simultaneous lymphopenia and monocytopenia (Fauci *et al.*, 1976:304-15). Similarly pharmacological studies show that beta-agonists (which mimic the effects of catecholamines) produce increases in circulating NKC and that beta-blockers reverse this effect (Mills *et al.*, 2000:137). In addition animal studies also indicate that elevated circulating levels of both glucocorticoids and catecholamines can suppress production of pro-inflammatory cytokines at a wound site (Gouin and Kiecolt-Glaser, 2011:86-7). In other words the close relationship between the HPA axis and the immune system can lead to situations in which abnormal activity in the former has knock-on effects for the latter. I will return to this issue of the potential effects of dysregulation when outlining the proposed model for connecting relationality with health in the final section of the chapter.

In summary then, this subset of experiments dealing with immune and endocrine function in the context of close personal relationships allows a number of observations to be offered to the transversal synthesis from the PNI perspective. Firstly, aspects of how relational connection is realised appear to have direct immunological and endocrine sequelae; secondly, these play out to two distinct timescales with different short and long term consequences. Thus whilst more negative forms of relational expression have short term effects that appear to convey some health advantages in terms of immediate response to invasion or insult (I will return to the issue of wound healing in the final section), in the long term they appear to have adverse consequences from the perspective of health maintenance. Since these long term alterations replicate those seen in chronic stress, the tendency has been to couch explanations of the effects of marital relational quality in terms of it either acting as a form of chronic stress in its own right (Robles and Kiecolt-Glaser, 2003:409-16) or as both a potentiator and a buffer of chronic stress (Slatcher, 2010:455-69). However, such effects can also, when set in the framework of allostatic maintenance and overload, also be understood as indicative of maladaptive system re straints stemming directly from the way in which relationality is realised. This does not preclude or supersede a stress-related framework; rather it can be seen as one possible pathway through which this can be realised. This possibility will be expanded in section 4 when all the different strands of the thesis argument are finally drawn together.

Viewed from an evolutionary perspective, the emergence of relationality from systems carrying out social signal surveillance has improved our capacity to efficiently process information from these and thus enabled us to build more complex internal models of the world to direct behaviour and improve survival. At the same time, it has also brought in its train the ability to form and sustain personal relationships which contribute to our own personal well-being, development and flourishing; and the absence or etiolation of such relationships is accompanied by the complex feelings associated with loneliness.[23] The issue of whether this relational dimension is also simply a servant of the reproductive safety/kin security aspects of tribal/species survival within the evolutionary dynamic is a moot one: data from fMRI studies of social exclusion (Eisenberger *et al.*, 2003:290-2) and cooperation (Rilling *et al.*, 2002:395-405) appear to indicate that physical pain and social pain share an overlapping neural substrate, as do cooperation and reward processing. This had led to speculation that because of the adaptive value of mammalian social bonds, the social attachment system may have piggybacked onto the physical pain system to promote survival (Eisenberger *et al.*, 2003:291); and from thence to the hypothesis that loneliness can be completely accounted for within an evolutionary framework and in the service of the 'selfish gene'(Cacioppo *et al.*, 2006:1054-85). The argument here is essentially that the social pain of loneliness and the corresponding reward of connecting with others is what motivates the person to repair and maintain social connections even when their immediate self-interests are not served by the sharing of resources (ibid:1055).

However this seems to involve something of a chicken and egg scenario; it also seems to insufficiently account for either the fact that lonely individuals are just as likely as non-lonely to interact with other people, or why the former perceive and judge such interactions to be of poorer quality and providing less comfort and support than the latter (Hawkley *et al.*, 2003:105-20). Indeed in many of the studies cited, the language used to evaluate relational quality goes well beyond the language of threat or even simply belonging. In other words poor relational quality does not seem to simply be linked to survival threat: For some reason the 'feel' of how we express and experience relationality varies in ways which we detect and which seem to matter. It would seem therefore that just as relationality as

[23] i.e. perceived rather than objective social isolation (Hawkley and Cacioppo, 2010:218).

emergent is about more than summative social signal decoding, so emergent relationality as experienced is more than mere functional connection. Thus this too needs to be considered in any attempt to tease out the links between social connection and health, and since this discrepancy in relational feel is located in conscious embodied experience then it seems appropriate for further exploration to also focus on this level.

The question is how best to do this in a way which recognises and responds to the challenges peculiar to the conundrum of investigating a situation in which we, as both observers and observed, are inextricably enmeshed. Here the transversal method once again proves useful, providing as it does the opportunity to introduce a completely different path for enquiry through which to expand understanding. In this instance, the theological contribution to transversal exploration and synthesis comes from Gabriel Marcel. Marcel's approach to investigation in situations where the ontological status of the investigator cannot be divorced from the subject of enquiry offers a way of responding to the inherent challenge encountered in exploring the contours of our relational experience. The fruits of this approach as he himself has applied it to the issue of intersubjectivity (his corresponding terminology) also provide some material for addressing the explicit question of *why* there might be a variable feel to this.

6.3 Distance or disponibilité: a Marcellian perspective

In Chapter 2 I argued that a benefit of following van Huyssteen's postfoundational approach was the increased flexibility conferred – in a number of domains – as to how science-religion dialogue might be usefully done. One of the aims of this project has been to demonstrate, on a chapter by chapter basis, both a variety of ways in which shared material can be used to generate transversal outputs, and that very different types of theological voice can be legitimate contributors to this end. Part of this has involved discussion of the respects in which these can be said to engage methods or display skills commensurate with transversal rationality. In this final contribution, I suggest that Marcel's characteristic and innovative narrative style utilises the coefficient dynamics of Schrag's 'transversal rationality' (Schrag, 1992:9, 63) in a particular and distinctive way which also honours his own specific philosophical/theological commitments. Since there is a close overlap between this contention and the way in which he addresses what I have suggested

as being a fundamental problem here, I propose to expand and examine these aspects in tandem in the next section. In the second section, with respect to the more explicit issue of why relational connection can sometimes 'feel' less rewarding, I will discuss some resulting Marcellian insights on intersubjectivity, in particular his delineation of 'availability' or *disponibilité*.

6.3.1 Problem and Mystery: Marcellian method as transversal

Unlike the Cappadocians and von Balthasar, Marcel has undergone no recent renaissance; on the contrary he has become distinctly less fashionable since the Personalist heyday of the mid 20th century, but despite this eclipse he retains a perennial relevance (Wood, 1999:94). His is also very much less obviously a primarily *theological* voice, but in this respect the transversal model's underlying philosophy once again allows for a more expansive approach to identifying these. Thus Marcel, though not overtly addressing what might be considered as the typical disciplinary themes, or beginning from the usual primary theological starting points, nevertheless writes about something which is a major theological interest *viz.* the experience of embodied being. Furthermore, whilst making little explicit appeal to such, he writes within a framework which is deeply informed by and orientated towards a Christian understanding of God (Marcel, 1973:237-43). This combination makes him an ideal dialogical partner since he is writing neither in defence of specific doctrinal formulations, or a more general Christian apologetic – in fact he specifically rejects these as being incompatible with the intellectual honesty that is the 'first duty' of both philosopher and dramatist (Marcel, 1963:113). Instead his avowed intent as 'a philosopher of the threshold' is to explore the experience of humanness in such a way as to 'somehow stand with believers, with the Christian religion […] but also speak to non-believers, make myself understood by them' (Marcel, 1973:240); and against the potential charge that his ideas imply an unformulated reference to Christianity, he steadfastly argues that they neither depend on, nor pre-suppose, its data (Marcel, 1930/2001:106). His is also a well matched contributory voice in some of his key themes intersect directly with both the scientific concerns of the current chapter and with the theological material discussed in earlier chapters. This provides not only the necessary locus for a transversal space dynamic to be developed, but also a way of drawing various project threads together.

Like von Balthasar, Marcel defies easy categorisation (Tattam, 2013:1) – strongly rejecting the 'Existentialist' label, he instead considered himself as a neo-Socratic (Marcel, 1927/1952:xiii; 1973:237-8) whose role was to help others discover their essential selves (Smith, 1969:26). Similarly, he also displays a creative approach to thinking which again seems very well suited to the openness of transversal dynamics. In this respect, his involvement with both drama and music – as playwright, critic, and concert pianist – make significant contributions to his thinking (Marcel, 1963:5,50; 1973:231). The resultant writings are diffuse and wide ranging with no attempt at either a synoptic or a systematic presentation of his concerns.[24] Indeed 'the conviction that reality cannot be "summed up," that this is indeed the last way in which it can be apprehended' was an early insight (Marcel, 1948:93); and the consequent rejection of philosophy as *system* (particularly as handed down from Kant through Fichte and Hegel) which was evidenced by the *Metaphysical Journal* (Marcel, 1927/1952), remained a key Marcellian hallmark. Instead, Marcel conceives philosophical work as excavation (Marcel, 1973:218-9) and exploration (Marcel, 1963:6-8) – an 'adventure taking place within the greater adventure of human thought itself ' (Marcel, 1973:11). This approach is perfectly illustrated by the *Metaphysical Journal* with its workbook style in which false starts and detours, internal dialogue and persistent self-criticism develop into a slowly progressive cumulative understanding.

In Marcel's case, the philosophical adventure takes the form of investigating the dimensions of human existence, and in this pursuit his dramas form a particularly important vehicle through which he develops his understanding of the shape, tensions and redemptive possibilities of intersubjectivity. As such, excerpts from these plays feature prominently as points of discussion in his philosophical writing, and their critical role is indicated by his likening of them to 'an underground stream whose overflow, often scarcely perceptible, irrigates, as it were, my speculative thought' (Marcel, 1963:5). In fact it is in this use of both his own personal narratives – his writings are full of biographical detail and anecdote – and those of his characters, that one can most clearly see the operation of the coefficient dynamics of Schrag's 'transversal rationality' (Schrag, 1992:9, 63). As discussed in Chapter 2, Schrag's first movement of 'praxial critique' calls for a dialectic of par-

[24]A brief biographical tracing in *The Existential Background of Human Dignity* (1963) is the closest to the former; the 1948/50 Gifford Lectures are the nearest he approaches to the latter.

ticipation and distanciation. The former is something which already sits at the very core of Marcel's thinking, since participation – in one's own body and from thence in the material world, and thus the lives of the others as friends, family, and community – is the key dynamic in his unfolding of the notion of Mystery. It is in this notion of Mystery and its differentiation from that of 'problem' that Marcel shines a light on the foundational difficulty under investigation here.

Essentially Marcel distinguishes two different types of situations which engage human enquiry. The first – which he designates as problems – do not involve the unique individual: they only require 'thinking as a thinking being' and the information needed to do this is in principle accessible to any thinking person. However some things are not merely external problems to be solved, i.e. they are not ones with which we can engage as a subject confronted with objects; on the contrary they are ones in which the self is *itself* involved, and as such they therefore demand a response from the individual *in their uniqueness* (MacDonald, 2001:84). When we deal with the former situation, we work on the available data without needing to take into account the *I* who is at work; but with the latter, our own ontological status becomes part of the issue, which we thus cannot simply regard as an object to be deconstructed and analysed. Hence in such scenarios we move *beyond* the realm of problem into that of the *meta*-problematic or Mystery. In the former, the intelligibility of the problem is extrinsic to the observer, whereas in the latter, the intelligibility of the meta-problem involves his personal participation. In effect Mystery (which Marcel absolutely resists conflating the *unknowable*) is 'a problem which encroaches on its own data' (Marcel, 1930/2001:90-3). In other words, what Marcel suggests is that there are not simply 'problems to be solved', there are also 'mysteries to be encountered', and that each of these will require a very different form of engagement. Thus our own incarnatedness, along with its expression in relationality, is not something which we can hold at arm's length to scrutinise and dissect – it is the reality *within which* we are inescapably included and constantly involved (Lowe, 1986:xii). Exploring its contours therefore necessitates achieving some reflective distance on our being 'in the middle' without simultaneously distorting our intimacy *with* that middle (Desmond, 2003:135).

Here then we begin to see the nature of the dilemma posed by trying to investigate our relational connections with the Other: to approach the issue at the level of a problem is firstly to ignore that we are ourselves included in the data under investigation in a very particular way, and secondly to deny the subjectivity of the one to whom we relate. In other words it is to confuse or conflate problem with Mystery, and thus to approach the ground in such a way as will ensure that a vital element of understanding it completely eludes our grasp. Marcel – using both the description of experience and the reflective clarification of Mystery to enable a more expansive exploration of the dimensions of human experience (Hanley, 1995:132) – has evolved his own particular way of escaping this distortion imposed by reductionist interpretations derived exclusively from empirical observation. It is here that the (albeit unknowing) employment of Schrag's transversal dynamics can be most clearly seen. But in order to appreciate how this is the case, it is first necessary to set 'problem' and 'Mystery' and their associated forms of engagement back into the larger framework of human awareness.

For Marcel there are three distinct levels to such awareness: at the base, there is a pre-reflective level of exposure to sense data in which one is aware only of one's existence in a concrete situation. Since this level is the primordial act of life, its 'lived experience' provides the ontological foundation of knowledge. Hence this is where values like fidelity, hope and love are originally encountered, rather than as part of some rationally reflective conceptual cognitive process (Bryson, 2008:xii; Michaud, 1995:15). Here Marcel clearly anticipates Ricoeur's anthropology in which philosophy proceeds as 'a second order elucidation of a nebula of meaning that at first has a pre-philosophical character' (Ricoeur, 1986:4); and there is an equally obvious connection with Schrag's 'pragmatic understanding arising […] from our participation in the ongoing life of our intercommunal situatedness in the world' (Schrag, 1992:64). Arising out of this initial level comes what Marcel terms 'first reflection', which is characterised by a 'spirit of abstraction' (Marcel, 1927/1952:ix). This is the level of 'problem' where subject/object dichotomy develops as that which is Other to ourselves is categorised, objectified and analysed as a means to understanding it. Marcel views this type of analytical reduction – in which *every* issue and encounter is broached as a problem to be solved – as inexorably leading to the 'broken world' described in his Gifford lectures (Marcel, 1960a:22; 1973:15, 229). To overcome this, what is needed is a recovery of par-

ticipation in Mystery and thus a move to the level of 'second reflection', in which the Other is no longer grasped as a problem to be analysed and solved, but is instead encountered as Presence to be experienced (Marcel, 1949:117; 1952:129; 1960a:83). A vital element of 'second reflection' is thus its 'recuperative' recovery of the primary sense of participation overthrown by the abstractive approach of first reflection (Marcel, 1960a:102-3), and the 'recollection' of our being as a 'unified whole' consequent upon this (Marcel, 1948:12).

But whilst participation is thus firmly enshrined in Marcel's philosophy, distanciation – involving as it does not just a stepping back *from,* but also a critical assessment *of*, that knowledge which participation furnishes – appears at first sight to present something of a problem, particularly when it comes to his investigation of intersubjectivity. The obvious difficulty is that the critical assessment of praxial critique is essentially a movement of first reflection, and the necessary reductive analysis of that is anathema to Marcel when it comes to considering the Other and our relationship with them: to consider these in terms of a problem to be grasped and analysed, and to employ deprecatory formulations of the '*this* is only *that* […] *this* is nothing other than *that'* type are essentially an attack against the integrity of the real (Marcel, 1952:156) as well as attenuating the thinker's own participation in being. A line from Marcel's play *L'Iconoclaste* sums up the problem with exquisite succinctness thus: 'Knowledge exiles to infinity all that it believes it embraces'. But since second reflection – the level at which Marcel wishes to locate the articulation of Presence – 'cannot provide the occasion for problematising', involving as it does the exact inverse dynamic of relaxation and release (Marcel, 1963:86-7), it cannot in any sense stand as a substitute as a distanciational manoeuvre.

But whilst Marcel obviously has no notion of trying to follow Schrag's transversal dynamic, nevertheless his way of opening up some reflective distance on intersubjectivity without reductively analysing it and thus distorting or destroying Presence, arguably achieves the necessary degree of distanciation to enable a legitimate critique of participatory knowledge. Moreover he does so in a creative way which is not only faithful to the intersubjective ontology he espouses, but also allows him, by virtue of his own *disponibilité* (see further below), to model it through his philosophical *modus* (Tattam, 2010:228). Essentially Marcel's style

structures his philosophy to itself engender an intersubjective experience – through both the narratives of the written work and the stage plays (the latter frequently also used as exemplars in the former) – between himself and his reader. Marcel uses this to allow the narratee/audience (and himself) to simultaneously distance themselves from their own particular situated experience and yet, through being presented with material within which they can find points of identification and intersection, to reflect on these in a non-reductive participative way. Thus his dramas do not begin with abstract philosophical ideas about Presence which are then dramatically illustrated, but from concrete situations of human estrangement and solidarity which then involve imaginative and evolving explorations and enactments of resistance and reciprocity. Marcel claimed that he neither dictated to his characters, nor indeed *could* force their actions to conform to any preset philosophical agenda. Instead he had to await and respect the discovery of how they would react to the specific unfolding situations, and thus his dramas do not necessarily reach neat conclusions (de Lacoste, 1995:74; Hanley, 1995:123; Marcel, 1963:60-2. 106, 117). Indeed they often have unexpected elements and endings which leave the audience with questions requiring reflection on and retrospective reconstruction of the drama in the light of these (Hanley, 1998:19). As Marcel expresses it

> these [fundamental problems] cannot be solved by the dramatist […] the question is rather to hold up to the spectator a sort of magic mirror in which he finds his own problems, his own difficulties, with the result that through the mediation of the drama itself, there will emerge this awareness which, most of the time, remains in us as though benumbed and inarticulate (Marcel, 1963:107).

Immersion in the life-world of the *dramatis personae* enables the audience to experience and even participate in that which their experiences open up (Hanley, 1998:22).

In the same way Marcel also unfolds his own personal narrative across his writings, where it functions as a construction to be 'nourished' by participant experience (Busch, 1995:181-2; Marcel, 1960a:190-5). Marcel understands such narratives as neither simply a mirror nor a neutral documentary study, but instead as selected and summarised sequences which shape things in terms of meaningful episodes and which can awaken echoes or set strings vibrating (Marcel, 1960a:191-3) as they call out to others for recognition or confirmation. As this

happens, subjectivity passes into intersubjectivity which, while it is entirely different from the shared third person objectivity of science, can nonetheless surpass the limits of the individual first-person consciousness taken in isolation (Marcel, 1973:6).

The employment of these different spheres and modes of engagement allows Marcel to present both the genesis and the process of his thought 'with all its falterings and flights, its matured fruits and undelivered suggestions' (Desmond, 2003:135) to his audience. In so doing he not only facilitates a mutual distanciation through the resulting intersubjectivity, but also simultaneously integrates this with a similarly distinctive and creative variation of Schrag's interactive articulation and discursive disclosure. In the end it is as much from these narrative and dramatic interactions as from the philosophical ideas themselves that the deeper understanding which he is trying to awaken flows. This in turn fits in with the Marcellian conception of the philosopher's job as being 'much less to *prove* than to *show',* where such showing is not about establishing empirical facts but about making things 'ripen', and thus promoting and transforming them (Marcel, 1973:31). As we will see shortly, there is also something of a feel of 'ripening' in Marcel's account of the place of intersubjective engagement in the development of persons and in this respect, a strong intersection with both of the previous theological voices.

However whilst the Marcellian approach thus sits very comfortably within a transversal dynamic, and though there is a clear intersection of interests, a potential question mark still remains: given Marcel's opposition to a certain type of reductive analysis, is he still a viable dialogical partner for the PNI and CGN perspectives offered in this chapter? Two things add weight to the affirmative evaluation here: firstly, as discussed in Chapter 2, prior agreement is not a *sine qua non* of attempting transversal space dialogue, and dissensus and diversity are recognised moreover as playing key constructive roles in developing ideas. There is thus no in-principle reason why this difference should disqualify Marcel, especially given the other dialogical positives which have been noted. Secondly, Marcel is not opposed to the scientific method of reduction and problematisation as a means of investigation in an absolute way; rather he is concerned to challenge the unreflective assumption that reality at large is nothing more than the sum of its analysable

parts, and to oppose the hegemonic hold of science over things beyond its remit (Desmond, 2003:136). In effect he wants to stand against the vision of the world described by Janke's '*praecisio mundi',* in which only that which can be measured and quantified is 'real' (Janke, 1999:263), and affirm instead that ultimately the real is 'always more than anything I can say about it' (Marcel, 1948/2002:224). In these respects he also clearly falls within the remit for more expansive enquiry which was outlined and espoused in Chapter 2 as the larger orientating framework within which the project is situated.

Marcel's first transversal space contribution is thus methodological and comprises a number of elements: firstly, he confirms and reflects back the challenge which the scientific analyses already face regarding explanations of why the 'feel' of relationality is important in ways which do not immediately seem to be simply functional. Secondly, he suggests that the answer to such questions cannot necessarily be found purely in reductive analyses of assorted kinds since, in considering the problem simply from the perspective of the body-object, we lose its connection to the body-subject; and it is the latter, as it participates in being through intersubjectivity, where the dynamic of connection operates and where its different dimensions are experientially encountered. Finally, the form of second reflection established through his particular and creative approach to participation, distanciation, and reflection, provides 'a rich ontological repository for conceptual analysis' (Bryson, 2008:xii). Thus he offers a different way of exploring variations in *how* relationality might be expressed and experienced at cognitive level which, though very different from analysis at synaptic or hormonal levels, forms a vital adjunct to these in expanding our understanding of relational ontology and thus of its potential connection to health. However his own explorations of intersubjectivity through his writings and plays have also generated insights into what underlies this differential in connectional feel which also have much to contribute to the chapter exploration in their own right.

6.3.2 Relational hospitality: presence as participation

As I suggested in opening, Marcel's intersubjective ontology has very obvious points of connection with the previous theological contributions. Thus there is a clear parallel between the Cappadocian understandings of relation as constitutive of personhood set out in Chapter 4 and both Marcel's understanding of being

with as the nature of all being (Michaud, 1995:16), and its associated rejection of a hermetically sealed Cartesian 'I think' in favour of a more expansive metaphysics of 'we are' (Marcel, 1960b:10). Similarly the Marcellian themes of incohesion and permeability, their associated and implicitly kenotic imperative to 'make room for the other in myself' (Marcel, 1948/2002:87-91), and the sense that doing so is also a necessary element of realising one's own full identity (Marcel, 1930/2001:105; 1948/2002:34,36,163; 1949:78; Smith, 1969:26), have strong resonances with von Balthasar's placing of self-restraint at the heart of the relational dynamic. Here then, between three very different theological voices, is another example of Haack's 'pervasive relations of mutual support' (Haack, 2009:57), in this instance for the view of relational connection as being both a constitutive but more than merely functional element of humanness which this thesis has sought to advance. However Marcel also brings another layer of understanding to the picture through his examination of the *attitudes* which enable, structure, and sustain this dynamic; and the apparent antimony between separation and connection which lies at its heart. To this end he draws on the interconnected motifs of availability and hospitality as ways of exploring and articulating how relational space is simultaneously created and bridged in the encounter with Presence. As with the idea of Presence itself, availability and hospitality, perhaps unsurprisingly since they too are operative in the realm of Mystery, are not easily amenable to neat deconstruction and analysis, but are more easily grasped as conceptual *Gestalts*.

Like von Balthasar, Marcel assigns freedom a critical role in facilitating intersubjectivity, with any I-Thou encounter being co-constituted by a 'dialogue of freedoms' between self and other. Such dialogue involves an appeal from the 'I', which the 'Thou' is free to ignore, postpone, refuse, or respond to – with the gratuitous and reciprocal gift of presence occurring if both agree to the implicit 'contract' (Marcel, 1948/2002:38-57; 1998:172-197). Hence Presence cannot be forced, claimed, demanded, manufactured, or bought – it can only be *accepted* as a gift freely given. At the same time Marcel rejects any notion that relational connection can be fully or adequately understood in terms of using and being used, even when the using is 'reciprocal, fair, knowing and consensual' (Godfrey, 1995:120). This suggestion that there is more to genuine human relationships than mere utility, is unsurprising in light of Marcel's other ontological commit-

ments and the importance he places on intersubjectivity as a key element of the experience of Being. In keeping with this, his dissection of the attitudes lying at the heart of all relational connection, and which fundamentally determine its nature, have their roots in his key differentiation between problematisation and participation – and thus in whether we approach the Other at the level of problem or of Mystery.

For Marcel, an essential ingredient in the second approach is the degree of *disponibilité*[25] of those involved in the relational connection. Indeed since Presence can only ever be offered as a free gift and received as a free offering, *disponibilité* constitutes a *sine qua non* of its generation: 'Presence is response to the act by which the subject opens himself up to receive; in this sense, it is the gift of oneself. Presence belongs only to the being who is capable of giving himself' (Marcel, 1967b:153). What is very clear however is that for Marcel the concept of *disponibilité* extends far beyond any simplistic or obvious notion of what such availability comprises; thus even the most conscientious listener can convey unavailability – and a material gift or visible action, no matter how lavish, is not necessarily a sign of Presence:

> There is a way of listening that is a giving of oneself; there is another way of listening that is a refusal, *a refusal to give oneself…*the being who is available is the one who is capable of being totally with me when I need him or her; the being who is unavailable is the one who seems to extend a temporary loan from among the considerable resources that are at his or her disposal. For the first I am a presence, for the second I am an object' (Marcel, 1998:192, original emphasis).

Marcel construes this unwillingness to be available in terms of an alienation in which, whilst we can listen and even respond to a story related to us of someone's misfortune or need, we are essentially unmoved by it. We may well recognise a contradiction between what we deem we *ought* to feel and what we actually *do* feel – and indeed feel pained or diminished by this. However we place it within a claimed framework of limited capacity to respond to all need, thus allowing this particular situation to be designated as *'only a case'.* For Marcel, what characterises the one who is present or available, is that they do not think in terms of *cases* (Marcel, 1998:192-3).

[25] The nearest English translation – availability – does not do justice to Marcel's concept hence I will use his own term.

Marcel then traces this back further to what he labels a 'sclerosis' – a 'hardening of the categories in accordance with which we conceive and evaluate the world' (Marcel, 1930/2001:104). This in turn is seen as a part of an egocentric topography we all gradually develop in which we are at the centre of a series of concentric zones of decreasing interest and involvement whose demarcations become increasingly hardened over time, although encounters with unknown others can sometimes breach these, albeit often in only a temporary way (Marcel, 1998:193). In contrast to the enclosed, impenetrable nature of the sclerotic tendency, Marcel roots the possibility of openness to the Other in what he describes as porosity or permeability (Marcel, 1948/2002:87-8). Moreover he ascribes an ontological primacy to this 'in-cohesion', seeing it as an inescapable part of the human condition, as a fact before it is a task. Thus to welcome the Other is not to *make* myself permeable to them, but to acknowledge and accept the in-cohesion which I *already am;* likewise to give oneself to the Other is to affirm a bond which already exists rather than seeking to escape or destroy it (Westphal, 2002:xiii). Once again the common ground with the Cappadocian model of personhood is clear, as is the fact that a failure to make room for the Other is essentially an attempt to recreate the world according to an illegitimately seized ontological independence.

Seen in this light, absent or impoverished *disponibilité* has non-trivial consequences for both the potential *Thou* and the unavailable *I*. The former loses the Presence that could be both refreshing and the means of a revelation and further realisation of selfhood, in which one becomes 'more fully myself than I should be if I were not exposed to its impact'(Marcel, 1951b:252-3). Moreover in being reduced to the level of object/problem, the *Thou* is prevented from exercising their own capacity for *disponibilité*. For the *I* too, there is also a significant contraction of the possibilities, for both self communication and self-knowledge since 'I communicate effectively with myself only insofar as I communicate with the other person' (Marcel, 1948/2002:34). The vignette of Jesus' encounter with a Syrophoenician woman serves as an interesting exemplar here of the of the inherent possibility of expansion through the availability of the Other. In both its early Marcan form (Mk 7:24-30) and the expanded counterpart in Mt 15:21-8, the woman's evident and high-risk *disponibilité* is shown as resulting in a significant change in Jesus; moreover the uncomfortable nature of the exchange underlines the fact that encounters of Presence are not *necessarily* serene experiences. But

in addition to the potential stunting of self awareness, shunning connection also risks a dwindling of our experience of hope and freedom, since these too are also organically connected to the degree of our availability to Otherness (Marcel, 1930/2001:105; Marcel, 1948/2002:40; Marcel, 1949:78). Again there are interesting resonances, this time with the *shālômic* understandings discussed in Chapter 3, particularly the insight that being well related to oneself is inextricably linked with being well related to the Other, with disruption to the one having inevitable consequences for the other in terms of health and wellbeing.

But as well as discussing the consequences of its *lack,* Marcel also tries to tease out a little more clearly what the contours of *disponibilité* actually *are* (Marcel, 1948/2002:38-57). As already indicated, it does not simply equate to being a good, or even an attentive listener – some more fundamental basic orientation is necessitated in Marcel's view. This he states in the strong language of 'I belong to you' which he then expands as 'I am opening an unlimited credit account in your name'. However Marcel does not see this as a condition of slavery – on the contrary he couches it in terms of freedom and in a way which is strikingly reminiscent of von Balthasar: 'the best use I can make of my freedom is to place it in your hands; it is as though I freely substituted your freedom for my own; or paradoxically, it is by that very substitution that I realise my freedom' (ibid:40). Essentially then the degree of my *disponibilité* is a reflection of the extent to which I am both willing and able to make my resources – not just material, but also emotional, intellectual and spiritual – available to a particular Other for them to call upon as they need. Marcel's usual analogy is that the person who is unavailable is only willing 'to offer me a temporary loan raised on his resources' (Marcel, 1995:40; Marcel, 1998:192). One can thus see why Marcel assigns the language of alienation and sclerosis to unavailability and this is further underlined by the supporting concept of hospitality with which he entwines its diametric opposite of *disponibilité.*

To offer hospitality not only implies certain attitudes of readiness and willingness, but also that we receive the person to whom hospitality is offered into *our own home* rather than into some unknown or public place; in other words we welcome them into a place we not only *possess,* but also *experience as our own* (Marcel, 1948/2002:89). Hospitality is not about filling up an empty space with an alien

presence but 'of having another person participate in a certain reality, in a certain plenitude' and to provide hospitality is 'truly to communicate something of oneself to the other' (ibid:91). Here we see the connections with Marcel's notion of permeability and incohesion and their contrast to the nacre of sclerosis which, in allowing no finger hold to another, resists all possibility of their ingress into our domain. The dynamic of hospitality also necessitates that I am willing and able to make room in myself for the Other and this requires a fundamental shift in orientation since 'if I am completely absorbed in myself, concentrated on my own sensations, feelings, anxieties, it will obviously be impossible for me to receive, to incorporate in myself, the message of the other' (Marcel, 1948/2002:88). Hence as long as my concerns are my central preoccupation, I will always make the Other a means to my ends, any welcome will be pretence rather than Presence, and connection will be marked by grabbing rather than giving (Westphal, 2002:xiii). There is once again a clear sense that Marcel sees a close connection between our treatment of others (as regards how we express relationality) and our own state: withholding our resources does not just lead to the potential impoverishment of the Other, it also has significant effects on dimensions of our own lived experience and self-relatedness. Thus whilst availability is not without risk of abuse, unavailability is not a safe option either in terms of our own flourishing and health. In fact there is a strong sense running throughout Marcel's exposition of this bidirectional implication of good relational engagement and its results which is well captured by Rilke's notion of the ripening qualities of looking at and movement towards each other.

Ultimately Marcel thinks of *disponibilité* and its associated metric of hospitality in terms of an active *disposition towards* rather than as episodic occurrences – something which he captures with the description 'creative fidelity' (Marcel, 1948/2002:147-74; Marcel, 1951a:125-34). This deeply paradoxical notion, which is both difficult to grasp and define conceptually, sits at 'the very centre of the realm of the meta-problematical' (Marcel, 1998:188). Stated simply such fidelity stems from an commitment to the Other which will not in principle be called into question again (Marcel, 1948/2002:162). This is more than simply constancy (though this forms its rational skeleton), which Marcel sees as perseverance towards a goal, because it also involves Presence (Marcel, 1948/2002:153). Thus for example the impulse to continue, out of a sense of duty, to provide promised or

expected support when there is no longer a concomitant attitude of *disponibilité*, comes from constancy, not fidelity. The attendant internal and external struggles against feelings of, for example disappointment or irritation at the 'absence' on the one side and irritation or resentment at an 'oppressive' obligation on the other run the danger of culminating in mutual aversion (Marcel, 1948/2002:156). Against this, fidelity represents an I-Thou trustworthiness which involves a 'creativity of presencing that goes beyond anything merely habitual or dutiful' (Westphal, 2002:xii).

Marcel's concepts are, as noted, in some ways more easily accessible at the realised level and thus I want finally to briefly reconnect his account of relationality governed by *disponibilité* and hospitality to some of the Biblical texts already presented in detail in Chapter 3 by way of furnishing this possibility. In keeping with the project's model, the intent is not to appeal to these as a primary datum in a revelatory sense, but simply to offer them as examples which were deemed significant enough to remember, record, and hand on within the Christian tradition. In fact the texts show examples of Jesus in both *I* and *Thou* dimensions of intersubjectivity i.e. as both offering, and benefitting from, hospitable relational connection. In the latter category, the example of the Canaanite woman already noted, the mother/son exchange of Jn 2:2-7 and the anointing stories of Lk7:36-8 and Jn12:1-3 (p90) demonstrate the expansive and healing effects of *disponibilité* offered, recognised, and received. In the former, perhaps the most vivid amongst many possible examples of what it is Marcel is pointing towards with his description of offering someone a 'blank cheque to draw on one's account', of what it means to be faithfully available, are to be seen in the final two relational encounters recorded in the life of Jesus in Lk 23:40-3 and Jn 19:25-7 where Jesus remains available and Present to his mother and a dying man, despite his own extreme suffering(p91).

What Marcel's exploration and exposition suggests then is firstly that an ontology of relationality limited to usefulness (whether this is couched at Darwinian, social, or experiential level) is simply inadequate as an account of the nature of human relational connection. In this sense he confirms the apprehension raised through the experimental studies examined earlier that relational 'feel' varies in ways which we can detect and which seem to matter over and above any putative sur-

vival benefit. Secondly, that what shapes our relational connection is rooted in the basic orientation with which we approach the Other, and in whether we see them as primarily a problem to be solved or as a Presence to be encountered. In the first case, withholding ourselves not only denies their subjectivity, it also curtails and diminishes our own experience of relational connection with both the Other and ourselves; in the latter, the attitudes of hospitality, availability, and fidelity facilitate the possibility of a more generous, expansive, and mutually enriching encounter, which might legitimately be labelled *shālômic.* This strong sense of bidirectional flow in Marcel's analyses underlines the fact that, in terms of the consequences, how we *express* relationality is at least as important as how we *experience* it.

If we now bring together the theological with the scientific contribution to the transversal space, we can formulate an expanded account of realised relationality. Here the form of the transversal outcome is once again slightly different in that the two contributions come together as the obverse and reverse faces of the same coin – representing the embodied experiential and cellular levels aspects of a complex emergent phenomenon. Theological explorations indicate that the shape of realised relationality is not uniform but can vary in ways which significantly alter its richness and potential; experimental data from PNI and cognitive studies furnish reasonable evidence that poor relational experiences can directly affect events at cellular level.

In Chapter 1 I suggested that for neurotheology to claim legitimacy as a distinct enterprise, it must be able to produce and 'body forth' insights which are distinctively neurotheological in form and expression. In contrast to the approaches adopted by Ashbrooke and Newberg, the route towards this adopted by this thesis has been to consider neurotheology not as a hybrid neo-discipline, but instead as a *joint transversal venture* under the governance of postfoundational rationality, and thus answering to the epistemic standards inherent in this rather than to those of a specific discipline. This has allowed each discipline to contribute material to three transversal space explorations of different aspects of relationality. From these a series of transversal outcomes – 'belonging' neither to science or theology *per se,* but instead answerable to the epistemic standards of postfoundational rationality – have been proposed. With the final piece in place, these can

now be drawn together to form a neurotheologically derived model for one possible pathway linking relational connection to health outcomes.

6.4 Relationality and health: a neurotheological perspective

In the century since Durkheim (1897) first sowed the seed, the idea that social connection and health are in some way linked has been extensively investigated by various disciplines, becoming firmly established at both experimental and epidemiological level. Yet despite the wealth of empirical data generated in the course of these explorations, the question of 'how' remains an enduring enigma. Broad models have been proposed and assorted theses explored experimentally, but the complexity of the issues under investigation and the difficulties and limitations of scientific approaches to investigating these, means that the details of actual mechanisms remain tantalisingly elusive.

In an attempt to circumvent some of these difficulties this thesis has taken a radically different approach to investigating the connection. Beginning from a speculative thesis (based on experimental PNI data) that the experience of relationality *per se* directly moderates immune function, it has used a transversal methodology to build a three stage argument in support of this. In Chapter 4, using material from experimental social neuroscience and trinitarian theology to provide transversally interlocking evidential support, I argued that the forming of relational connection was a foundational element of being human, but I also raised the question as to whether *relationality* could be adequately explained as simply the summation of a suite of basic processes for decoding social signals. In Chapter 5, using a tripartite argument built from cognitive neuroscience data, kenotic theology, and PNI data, I advanced a case for considering relationality to be an emergent rather than a summative phenomenon and thus capable of exerting causal constraint over the diverse cognitive, endocrine, and immune components of social decoding and response. This final chapter has brought together a systems level and a cellular level perspective from theology and PNI respectively to suggest that the shape in which relationality is realised is significant and has non-trivial consequences. These three components can now be interlocked to propose a transversally derived model for one pathway linking social connection and health: this posits relationality as an emergent phenomenon arising from a com-

plex system of components dealing with social signal decoding and exerting causal constraint over elements of that system in ways which increase its predictive power, and thus the effectiveness of its response to different social scenarios. However the differing experiential possibilities of relational connection mean that the form and operation of such constraints may sometimes have consequences which are not beneficial to overall system functioning, and which may eventually lead to downstream health-related effects.

6.4.1 Allostasis: recognition and response

In order to understand how this might actually play out physiologically in terms of the diverse alterations in immune and endocrine function which have been noted in connection with relational experience, it is necessary to set the model in the wider context of organism maintenance and repair in the face of stress. In Chapter 3 I referred to the ambiguities surrounding the concept of stress noting that it is neither synonymous with damage nor necessarily compromises health. However the paradox of stress is the simultaneity of its adaptive nature and the possible maladaptive consequences of this. A helpful analogy here is with aspects of fire-fighting: whilst water is necessary to extinguish some fires, overuse can lead to more damage than the original flames; furthermore increased usage can lead to a drop of pressure in the supply system with the consequent decline in effectiveness then contributing to the spread of flames. In the same way, stress responses are necessary – indeed they are a central part of allostatic maintenance and ideally are beneficial – but they can also come at a cost to the body, especially if elicited too frequently, or managed inefficiently (Korte *et al.*, 2005:4-5).

For an organism to survive, it needs to be able to maintain its internal environment within certain ranges. Traditionally this has been understood in terms of homeostasis - maintaining stability through constancy – with the physiological goal construed in terms of the constant maintenance of all internal parameters at an optimum set point, and understood as being achieved by immediately correcting deviations from this point via negative feedback loops. However a more dynamic understanding has gradually superseded this in the last two decades. This allostatic model (first postulated by Sterling and Eyer, 1988), reframes the guiding principle as one of achieving stability through change (McEwen and Wingfield, 2003:3) and physiological response systems become understood in terms of achieving maximum efficiency – 'coordinated variation to optimize performances

at the least cost' (Sterling, 2004:26). Thus the goal of regulation is not *constancy* but *fitness* (see Sterling, 2004:17-64 for a good introduction to the concept).

Since the body does not store vast reserves of essential materials, this efficiency turns on reciprocal trade-offs which enable resources to be directed where most needed in response to dynamic situations. Crucially, effective resource allocation involves the ability to predict what resources are likely to be needed as a given situation arises; this in turn necessitates that any relevant system sensors are able to adapt their sensitivity to the expected range of input, and similarly requires each relevant response effector to adapt its output to the expected range of demand. This predictive capacity to anticipate demand, and facilitate rapid response shifts to meet this, is crucial to maintaining allostatic balance – and system sensors are a vital lynchpin in this.

Such sensors transduce a range of inputs which typically take the form of a sigmoid curve: the mid-point corresponds to the input which is statistically most likely, the steep curve sections bracket the likely range, and the shallow end curves represent the least likely possibilities at either weak or strong extremes. Thus events most likely to occur are matched to the greatest sensitivity and precision of the sensor. By detecting fluctuating environmental signals, sampling signal strength and calculating a new probability distribution, sensors adapt to keep the curves centred on the most probable loads. Such Bayesian adaptation is seen at all levels of biological organisation and draws on a combination of sense data and prior experience to produce a best estimate of what is happening (Sterling, 2004:30).

A critical element is therefore the ability of sensors and effectors to adapt their sensitivity to the expected range of inputs so that response is not triggered either unnecessarily or too slowly, and that it is sufficient to meet the challenge but not excessive to the point of causing problems itself. Such adaptation needs to be both fast and accurate with respect to the process being regulated, something which appears, from extensive work done on visual systems, to be done via a two-pronged prediction: firstly of the most likely state in the next moment (as captured from the current state and its rate of change); and secondly the most likely time course of the new state (usually best captured by time spent in current state). Accurate prediction of the second improves efficiency since all change in-

volves a physiological cost and the aim is to minimise this. Previous experience and higher cognitive functions also play an important contributory role to prediction (see further at p221ff*)*.

Effectors must also adapt to meet predicted changes of demand, but the higher cost involved means that this tends to happen more slowly. Adaptation takes a number of forms: internal cellular activities are adjusted to facilitate manufacture of required products, but also (and importantly) there is alteration of both sensitivity and numbers of surface receptors in line with predicted demand over a spread of possible timescales. Thus prolonged exposure of an effector to high levels of its particular ligand[26] leads to down-regulation with a reduction in both the number and the sensitivity of its surface receptors (Sterling, 2004:33). In other words the responsive arm of that particular physiological pathway learns that the baseline circulating level of its signaller is now set higher and adjusts accordingly so as not to waste resources producing unnecessarily in response to this. This becomes an important factor in the context of possible pathological dysregulation resulting from poor relational quality.

Physiological regulation also receives vital input from high level cognitive mechanisms such as perception, memory retrieval, planning, emotions etc. Information from sensory systems is relayed to and decoded in dedicated cortical locations and extracted information is eventually collated via the pre-frontal cortex with retrieved information from past experience. Emotional components such as anxiety, fear or satisfaction– many receiving input from social signal decoding mechanisms – are added, and a best estimate about the situation under consideration is made (obviously not necessarily as an act of conscious cognition) and appropriate action initiated at the relevant level. Generally speaking behaviours regulating physiological mechanisms tend to be rooted in either the drive to reduce anxiety or the desire to increase reward (Sterling, 2004:35-8).

Allostasis is thus essentially the fundamental process integrating physiology and behaviour through which organisms actively adjust to both predictable and unpredictable events in their environment. The primary mediators by which such changes are made and maintained are the hormones of the HPA, catecholamines,

[26] The signalling molecule which is specific to its cell receptors and thus which activates its response.

and cytokines (McEwen and Wingfield, 2003:3). An allostatic state (i.e. one where there is active response to change) must of necessity result in a temporary imbalance of the primary mediators, because of stimulated production of some and relative suppression of others consequent on resource allocation. Thus for example the paradox noted earlier in discussion of the wound healing experiments, where social threat (here in the form of a conflict engagement) leads to a simultaneous up-regulation of systemic elements of innate immune responses but down-regulation of tissue level ones. In this case, allostatic maintenance dictates that resources are diverted to deal with the more important environmental change and thus to elements of the cytokine system which can influence physiological and behavioural responses appropriate to regulating social threat, rather than those which control tissue inflammation. Such states can be maintained for limited periods provided energy input is adequate. However if for some reason the imbalance continues then allostatic load – that is, the cumulative cost to the body of adjusting physiology/morphology/behaviour to environmental change (McEwen and Wingfield, 2003:12-13) – rises. If the situation becomes chronic, allostatic overload can lead to pathophysiological changes with eventual health consequences.

6.4.2 Allostasis: relationality and regulation

Finally we need to set the suggested connectional pathway into this context to see where and how constraining effects might be operative and become significant. However two things need prolegomenous highlighting: firstly, as indicated earlier, the suggested mechanism is seen as operating at automatic rather than conscious level i.e. it is not merely another form of conscious cognitive appraisal to set alongside others already proposed in Uchino's model. At the same time, it does not preclude any of these also being pathways of connection between social experience and health. Secondly, the constraining influence proposed is at the level of receptor/effector sensitivity: thus in the studies discussed earlier, it is not the acute responses *per se* which are being ascribed to the shape of realised relationality – on the whole these simply constitute part of the spectrum of normal allostatic response to the various experimental social stressors (and thus are seen to some degree across the spectrum of couples studied irrespective of marital quality). Rather, it is the greater scale of these in various dimensions. With regard to longer term differences, these, as will become clear, can be seen as markers of

chronic dysregulation resulting from the threshold changes wrought by poor relational experience and its end stage effects.

In Chapter 5 I suggested that the extended range and depth of social decoding processes enabled by their incorporation into a complex system served an evolutionary end by increasing the resources and expanding the 'language' available for modelling; the improved ability to build and maintain maximally predictive models for detecting and responding appropriately to aspects of the social environment, conferring survival advantages. In this chapter I have further suggested that a key element of allostatic maintenance processes is successful predictive ability. This ability depends in part on accessing, at cellular, system, and cognitive level, previous experience of encountered states and situations. The suggestion here then is that predictive environmental modelling from social decoding and response systems intersects with allostatic predictive mechanisms at the level of receptors, providing information as part of sensor adaptation to keep detection curves centred on the most probable load in a given situation. In such a scenario, it now becomes possible to see how effects on immune and endocrine responses might be directly influenced by the shape of realised relational experience. If this is poor, then predictive modelling is likely to increase sensor threshold sensitivity so that allostatic responses are triggered at lower levels of social stress (since interpretation as potential threat is more likely) than in those who have less threat-sensitive comparative models.

Similarly, effector thresholds may be lowered (or, in the case of restorative regulatory elements such as the prolactin system, raised) to enable quicker and greater responses to perceived threat as a way of ensuring that maximum resources for adaptive or avoidance behaviour can be accessed and maintained for as long as possible. In this respect, studies showing uncontrollable social-evaluative threat (SET) to be an extremely potent form of social threat (Dickerson *et al.*, 2009:1237-44; Dickerson *et al.*, 2004a:1191-1216; Dickerson *et al.*, 2004b:124-31; Kemeny, 2009:1-9; Kemeny and Schedlowski, 2007:1009-18) are interesting and possibly suggestive. Controllable situations of threat to the social self are ones where employing active behavioural responses can successfully circumvent adverse social outcomes. In contrast, uncontrollable threats to the social self involve a context where active social responses may be ineffective and, in

some cases, even exacerbate conflict (Dickerson *et al.*, 2004a:1204) and studies show such stressors to evoke brisk and substantial cortisol and circulating cytokine responses (Dickerson *et al.*, 2009:1237-44). Indeed evidence suggests that social-evaluative conditions may have a greater capacity to elicit pro-inflammatory cytokines than any other type of laboratory stressors examined thus far (Dickerson *et al.*, 2004a:1203). As discussed in Chapter 3, these cytokines act on the CNS to produce, amongst other things, behavioural changes geared towards withdrawal from demand or danger as part of allostatic responses (as for example in 'sickness behaviour').

These social evaluative responses have tended to be ascribed primarily to higher level cognitive processes (Kemeny, 2009:4) i.e. they have been placed within the 'psychological appraisal' section of Uchino's model with 'sensitivity to rejection', and 'fear of negative evaluation' identified as important difference factors sensitising people to SET (Dickerson and Kemeny, 2004:355-91; Gruenewald *et al.*, 2006:410-19; Slavich *et al.*, 2010:39-45). However I want to suggest that these data could also be read as evidence for the adaptive threshold model being proposed here: if negative relational experience becomes tied to anticipatory perceptions of being unable to avoid certain outcomes, and if predictive relational modelling contributes to threshold sensitivity setting, then allostatic mechanisms triggering withdrawal/submission in the face of social stressors are arguably likely to be triggered at lower levels and to greater effect.

A number of studies of aspects of PNI function in conjunction with loneliness provide another piece of potential evidence. In these, the differential between the lonely (i.e. those with *perceived* social isolation) and the non lonely, was neither numbers of social interactions, nor level of exposure to objective stressors, but altered reactivity to them, both in terms of perception and physiological response (Cacioppo *et al.*, 2003:71-4; Hawkley *et al.*, 2003:105-20; Hawkley and Cacioppo, 2003:98-105; Steptoe *et al.*, 2004:593-611). Thus those with poorer models of relational interaction (as assessed from verbal description) had lower thresholds for perceiving and reacting to events as stressful. Moreover, evidence also suggests that activation of CVS regulatory mechanisms occurs via different routes in this group, possibly leading eventually to chronic dysregulation and associated hypertension in older lonely adults (Cacioppo *et al.*, 2002:407-17; Hawkley *et al.*,

2003:105-20). Other studies have also produced data linking loneliness to differential responses in endocrine, cytokine and cellular responses to acute stressors (Hackett *et al.*, 2012:1801-9; Steptoe *et al.*, 2004:593-611). Empirical evidence of autonomic, endocrine, and immune functioning suggesting that the physiological effects of loneliness unfold over a relatively long time period (Hawkley and Cacioppo, 2003:98), also offers support to the suggestion that poor relational experience leads to long term alterations in threshold sensitivities within allostatic systems, thus perpetuating a cycle of chronic dysregulation that eventually leads to health pathologies.

Additional collateral supportive evidence for the proposed link between relational experience of different kinds and threshold sensitivities can arguably also be adduced from various cognitive neuroscience studies. Thus for example at the level of neural substrate activation, individuals with high scores in rejection sensitivity tests, exhibit greater reactivity to facial expressions signalling potential rejection but not to threatening facial expressions in general (Burklund *et al.*, 2007: 238-53). A number of studies triangulating neural activity, social support and cortisol responses with experiences of rejection or threat also offer evidence that the link between good social connection and attenuated cortisol responses to a stressor test is mediated by diminished activity in cortical regions associated with the distress of social separation (Eisenberger *et al.*, 2007:1601-12) and involves enhanced inhibition of threat responses during threat regulation (Taylor *et al.*, 2008:197-211). Finally, in a very recent study, positive early experience of social support was subsequently, during an experience of peer rejection two years later, related to less activity in brain regions linked with negative affect and pain processing—an indication of less neural sensitivity to exclusion (Masten *et al.*, 2012:106-114).

In support of the idea that predictive models derived from relational experience might play an important role in allostatic network maintenance I want also to bring in the insights from Marcel discussed earlier, and the extent or not to which we encounter *disponibilité* in those with whom we routinely engage. The importance of *perceived* social support has been referenced in various discussions throughout the thesis as something which has strong correlations with health outcomes, and indeed sometimes more strongly so than *received* support

(Reinhardt *et al.*, 2006:117-29; Uchino *et al.*, 2012:216). Also of relevance is work suggesting that support perceptions are developed primarily in the context of daily, mundane interactions (Lakey and Orehek, 2011:482-95), and that such schemas serve as automatic organisational guides for navigating complex social worlds (Baldwin, 1992:461-84). Moreover, there is also evidence that simply re-calling support schemas is enough to attenuate physiological reactivity to a stressor (Ratnasingam and Bishop, 2007:308-16; Smith *et al.*, 2004:476-85). Here then theological, cognitive, and PNI perspectives all suggest that how we encounter the Other in our day to day living has a significant effect on how we set the basic relational schemas which then feed into different aspects of physiological function connected with social signalling and response: the way we experience and express our capacity for relational connection is the start of a cascade whose effects extend from the cognitive to the cellular with far reaching consequences.

To summarise thus far then, the model suggests a point of interaction between allostatic control mechanisms and predictive modelling arising from a complex system of social decoding and response, with poor relational experience leading to brisker responses at lower levels of social threat and stress. In essence, how relationality is realised acts as a constraining influence on parts of the social monitoring system in order to maximise appropriate response in the system as a whole. If we view this in the light of the Juarrero's argument that in downward causality, component constraints operate to increase the range of system possibility (p158ff): raising sensor thresholds (i.e. decreasing sensitivity) in line with positive relational experiences prevents unnecessary expenditure of resources and energy; conversely, lowering them in the light of negative experience allows earlier, greater and more sustained response, thus improving survival chances.

6.4.3 Relationality: dysregulation and damage

However as has been earlier noted, it is not the acute responses to stress *per se* which are necessarily injurious to health – indeed such responses are called up to maintain health in the face of environmental changes. The difficulty arises when responses are engaged too frequently or sustained inappropriately and allostatic overload occurs. In these situations, alterations in sensitivity leading to overstimulation and over production in one part, with consequent development of receptor resistance to circulating signallers in another can, because of the complexity of the interplay between the SNS and the HPA axis, lead to chronic dysregulation

with downstream effects with heath implications. In this respect the wide ranging effects of the cytokine signalling system at every level from the cell through to the behavioural, are clearly crucial. The possible scenarios of how this could play out are obviously beyond the scope of this piece; however a brief example of one possibility would be via the dynamic and complex relationship between cortisol and pro-inflammatory cytokines, one element of which is the suppression of the latter by the former. However sustained elevation of circulating cortisol (as for example in chronic stress) leads, via the mechanism described earlier, to a situation of glucocorticoid resistance as effectors adapt their sensitivity thresholds (Avitsur *et al.*, 2001:247-57; Miller *et al.*, 2002:531-41; Rohleder *et al.*, 2001:966-72; Stark *et al.*, 2001:R1799-1805). The consequences of this are a diminished ability to suppress production of proinflammatory cytokines (e.g.Miller *et al.*, 2002:531-541) – something which is also seen in those who are more sensitive to SET (Dickerson *et al.*, 2009:1237-44). The net result is a chronic elevation in the level of pro-inflammatory cytokines – whose role in various major disease groups was noted in Chapter 3 (p97-8)(see Slavich *et al.*, 2010:39-45 for an example of a theoretical model linking glucocorticoid resistance and inflammation to depression). Whilst it is also completely beyond the scope of the current project to discuss how these mechanisms become established, recent advances of understanding in epigenetics and social genomic point to possible ways whereby differing experiences of relational connection might become embedded at a biological level (see for example Champagne, 2010a:564-74; 2010b:299-311; 2013:33-41; Champagne and Mashoodh, 2009:127-31; Cole *et al.*, 2012:20578-83; Szyf, 2011:971-8; Weaver *et al.*, 2006:3480-5). The last piece of the model is hence to suggest that poor relational quality has both short *and* long term consequences for allostatic maintenance: thus it leads to greater amplitude allostatic responses, triggered at lower thresholds and more frequently in its own right, for the reasons outlined; but in addition, the constant resetting of sensors and effecters leads, over time, to chronic dysregulation in allostatic maintenance systems; this in turn has long term health consequences.

Thus finally we return to the point of departure for this transversal exploration and the notion of health itself. In Chapter 3 I discussed the perennial difficulties surrounding attempts to adequately define or delineate the concept of health; and as part of this I explored the tensions between the biomedical model which

currently dominates Western thinking and the biopsychosocial models which stand as the main alternative conception. In the former, health is construed primarily in terms of mechanical disruption and in relation to the individual body. – Porter's 'body as […] its own cosmos' (Porter, 1999:7). In the latter, with its wider emphases on not just the biological but also the psychological and sociological dimensions of illness, health is less easy to define so succinctly but is understood in a much broader and more connectional sense with a corresponding expansion of therapeutic targets. Though the dichotomisation is somewhat oversimplified, the tension is essentially between an understanding of health shaped by a Cartesian view of mechanised bodies and one shaped by a more phenomenological view of embodied persons. The neurotheological investigation undertaken in this project has produced a model linking relational experience with health outcomes which, whilst it builds on a large volume of data generated within the first paradigm, sits very comfortably within the second. In this instance at least, disruption of the mechanics and distortion of the life-world are shown to be intimately and inextricably entwined and the consequent view of health expanded and deepened accordingly.

Neurotheology: Matter and Method

Reflections on research objectives

> The historical record is like the night sky: we see a few stars and group them into mythic constellations. But what is chiefly visible is the darkness.
>
> (Porter, 1999:13)

> For the explorer, on the other hand, everything that comes into view is in some way welcome and appears as a sort of gratuitous gift which is like an enrichment for him who finds it and receives it.
>
> (Marcel, 1963:8)

This doctoral thesis has had two primary objectives – one focussed on 'matter' and the other on 'method', tied respectively to its twin research hypotheses that:

1. Relationality is an emergent phenomenon of a complex system involved in social signal decoding and response, and the way in which this faculty is expressed and experienced can directly affect health.

2. A dialogue between theology, psychoneuroimmunology, and cognitive neuroscience can both optimise the understanding of the nature of this connection, and facilitate the exploration of possible underlying mechanisms.

The first relates to an idea which has intrigued me since I was a final year theology undergraduate, and the second to a situation which has increasingly frustrated me as a postgraduate as I have tried to engage in dialogue with scientific (and theological) colleagues – particularly those *outside* the dedicated arena of science-religion. In this brief concluding reflection, I want to consider each of these objectives in turn and offer an evaluation of the degree or not to which the project was successful in meeting them.

Regarding the first hypothesis and objective, I believe the theoretical model laid out in the preceding chapter is reasonably well supported with regard to both the arguments offered for the basic thesis that relationality is an emergent phenomena exercise exerting causal constraint, and the postulated mechanism for how this might then mediate downstream health effects. Looking at the first element

of this, the epistemic contract for the selection of material allowed an argument to be built which did not rely on special privileging for either the scientific or the theological material. These can thus be robustly defended from the perspective of postfoundational rationality and epistemic responsibility both as regards their selection and their content. Furthermore Haack's model of interlocking evidence has allowed various problems, for example the limitations of the raw data and the problems of extrapolating between levels, to be addressed in a way which, whilst it does not decisively settle the matter, at least allows these to be circumvented them to some extent. In effect, it has allowed crossword entries to be pencilled in, even in the absence of questionable or missing letters, because of the presence of other intersecting ones.

However a combination of the inherent complexity of the issue itself, as well as of adopting a tripartite approach to it, and the inherent restrictions of an externally circumscribed project, (hence this is not a failure of the methodology *per se)* meant that ultimately the amount of development possible was far less than the issue warranted. Moreover, whilst the data examined indicated the possibility of some interesting overlaps and resonances – for example aspects of the Cappadocian understanding strongly prefigure findings currently emerging from cognitive neuroscience – space restrictions precluded me pursing transversal dialogue and exchange at the *interdisciplinary* level envisaged by van Huyssteen. There is clearly some interesting and rich potential to be explored and developed at this level, with the distinct likelihood that further dimensions, both for providing added support for the argument and for suggesting other possibilities to explore in connection with it, could be opened out. Being able to incorporate this additional dialogical dimension with its differently parsed cross-connections would add another layer of robustness to the basic arguments, and extra supporting intersections from the perspective of Haack's crossword model.

With respect to the postulated mechanism, this is admittedly more speculative. However its generation is in keeping both with Uchino's injunction that this is where the next stage of investigation and development should be directed (Uchino *et al.*, 2012:225), and with the well detailed complexity of the potential connectional pathways and the consequent difficulties of direct experimental investigation. In fact it is these very issues which have kept the first wave of PNI

studies on the topic tied into recording the connection rather than elucidating its mechanisms. In this respect the neurotheologically derived model I have outlined is more detailed than any yet coming from within the scientific disciplines, although it is inevitably somewhat simplistic and underdeveloped, given both the massive complexity of the systems involved and the restricted nature of the project. However within these limitations, I believe it accords well with both the mechanisms of allostasis as we are increasingly coming to understand them, and with a steadily growing corpus of data implicating dysregulation of inflammatory cytokine signalling systems as an important factor in various pathological processes.

Regarding the overall success or not of this dimension of the enterprise, Porter's observation on the experience of trying to write a history of medicine seems very apt: in pursuit of the first thesis objective, I have looked at many research papers, teased out a number of ideas and tried to link them together in a coherent way to essay an account of a possible link between social connection and health outcomes. Whilst I believe the model is coherent and defensible, what is most apparent in the end is how much is still completely unknown, and how many elements of the mechanisms of various postulated chains between social connection and health, remain almost as mysterious now as when the link was first described.

The second of the thesis objectives relates the issue of how the insights generated within theological frameworks of thought can be used to contribute to ontological knowledge about the world in a way which has valency and traction *outside* of the immediate science-religion loop. In Chapter 1, I raised the question as to whether and how this might be achieved by moving the focus of conversation away from things 'God' (and thus inherently causality) related, and instead developing conversations between theology and neuroscience centred on understanding aspects of humanness; and whether this could also be done in a way which also avoids the 'many voices issue'. Developing van Huyssteen's transversal space model has not only allowed the theology to make a contribution on an equal footing with science, but also has opened up a completely different possibility for how to bring together scientific and theological insights to explore an issue and expand understanding of it.

As regards the model's general success as a vehicle for exploring the connection between relationality and health, this has been dealt with to a large extent in the previous section. The development of both a transversally informed argument, and from this a coherent model which sits comfortably with both the strengths and the limitations of the empirical data, and which does justice to current understandings of allostatic and disease mechanisms, testifies its utility as a vehicle in this particular instance. However the main questions for consideration here relate to the extent or not to which the model has succeeded in bringing together the scientific and theological voice in a way which allows both to make an equal contribution without either requiring assent to dogmatic religious propositions by the former or emasculating the latter.

With regard to the success of the mechanics themselves, the model's underlying dynamics have allowed the identification of areas of sufficient intersection of interests to form a platform on which to begin a neurotheological project, and from which to facilitate the development of transversal outcomes consequent on this. The project also successfully demonstrated that the model's inherent flexibility allows a variety of possibilities for how such outcomes can be constructed in order to provide the interlocking support for justified belief envisaged by Haack. Thus in Chapter 4, whilst there were weaknesses and missing elements in the case offered by both disciplines, the two offered mutual support for each other in a way which enabled the answer to the question to be pencilled in despite some missing letters. In Chapter 5, whereas no one discipline could provide unequivocal evidence for all three of the designated hallmark features of emergence, each was able to furnish evidence for one of them, with the resulting strands integrated to form a transversal proof for the emergent nature of relationality. In the final chapter, both theology and PNI provided a perspective on the same issue but at different levels of operation. This time these were conjoined to provide complementary facets of understanding a complex whole, operating in effect like the obverse and reverse of a coin, with each side bearing different information, but each necessary to complete the whole. Each of the transversally supported outputs was then used in a similar interlocking way to build the argument from which the final model was derived.

These transversal conjunctions were themselves possible because the dynamics underpinning the model also successfully facilitated the selection of theological material which was epistemically defensible from a postfoundational perspective. Once again the inherent flexibility and thus the expansive possibilities of the approach were demonstrated by the very different ways in which different theological approaches – both classical and modern – can be shown to employ the tools of post-foundational rationality. Thus with the Cappadocian contribution in Chapter 4, the emphasis was on the responsive evolution of ideas in the light of critical challenges; with von Balthasar the focus was on his way of drawing out connections and knitting together widely disparate material to expand and amplify understanding; and with Marcel his creative approach to the conundrum of how to critically investigate something when we ourselves are part of the data under consideration. In this respect there is also an overlap with Morin's suggestion that one of the necessary ingredients of developing complex knowledge is the integration of the knower back into the knowledge (Montuori, 2008:xxvii).

The end result of this has been the development of a dialogue which is somewhat different from those generally encountered in the science–religion literature: it is not centred on issues relating to God and causality; it makes no appeal to privileged theological material; it does not require concomitant assent to religious propositions in order to accept its validity; and finally its primary object is expansion of general knowledge, not apologetic intent. In all these respects then the model seems to offer a richly promising way of taking the science-theology dialogue in a very different direction. However the question still remains as to whether the theology is ultimately eviscerated by these manoeuvres to such an extent that it becomes the debased coinage which Aristos and Polyphilos discuss in the 'Garden of Epicurus' (France, 1908:208-9) or the anaemic myth which Westhelle (2000:171) warns against. However Westhelle's criticism is raised against a scenario in which theology seeks to rescue itself 'not on the basis of its unique claims of thinking about and within the limits, but in subservience to powers and knowledges that too often discipline its discourse' (ibid:172). Whilst it is true that there is no explicit appeal to God or to specific religious propositions in the material ultimately contributed to the transversal work in this project, nevertheless such material is undeniably generated within a religious framework using the tools and motifs of, and arising out of grapplings with, specific religious questions.

Moreover, the model's framing within a paradigm of post-foundational rationality and the transversal dynamic which regulates it, mean that in fact theology is free, contrary to the normal scenario, to contribute its own unique insights without these having to answer to particular epistemic criteria which are domain specific only to science, rather than to rationality *per se.* It thus stands as the exact opposite to that which Westhelle decries, and far from being 'debased coinage', it represents a way of harvesting theological riches to be used in a more expansive conversation with science than is currently possible.

Finally I want to return to the vexed issue of neurotheology itself. In Chapter 1, I argued that both Ashbrooke's and Newberg's attempts to develop or delineate this suffered from a number of serious problems regarding the triple metric of engagement outlined there. I suggested that for neurotheology to succeed, then with respect to 'encounter' better specification of dialogical loci and selection of contributory material were needed; regarding 'exchange' that a robust and defensible methodology was required; and finally that 'expression' necessitated not just the generation of coherent outputs, but also the development of a distinctively neurotheological discourse. The model developed and used here addresses the first two comprehensively and with demonstrable success; similarly with the first part of the final element. Ultimately however, it remains a moot point as to whether the discourse generated can be properly labelled 'distinctively neurotheological'. In this respect, the experience of doing this work leads to me argue that ultimately, neurotheology is much more fruitfully understood and engaged with as a transversal *venture* rather than a hybrid *discipline* i.e. as *process* rather than *corpus.* The change in approach between the early paper reproduced in the appendix and the current work is obvious, and is reflected both in the progression of the thesis title away from its original form of 'Towards a Neurotheology of Health' and in the designation of the final project outcome not as a *neurotheology* of relationality and health, but as a *neurotheologically derived* model for a possible pathway linking the two. I believe that such an approach not only opens up a potentially fruitful new approach for engaging the discourses of science and religion, but is also a way of addressing the wider epistemological issues which were sketched out in the introduction.

I began the project with some lines from Alice Fulton's poem 'Cascade Experiment' with its suggestion that the unknown only reveals itself as we move towards it, and which captured something of the feel there was when starting out on this transversal venture. Similarly the words from Marcel with which I end seem a good summary of how I have found the process: approaching the journey from a different perspective, with no clear idea of what would transpire, or where it would end, so much that has come to hand in its course has turned into fruitful contributions to my thinking on issues beyond simply the one explored here, often expanding or challenging it in unexpected ways. Although the passage has taken longer, and been more difficult – and at times painful – than I anticipated, yet in the end I find myself enlarged and enriched by it.

Bibliography

Achard, S. and Bullmore, E. (2007). Efficiency and Cost of Economical Brain Functional Networks. *PLOS Computational Biology* 3 (2 /e17), pp.0174-0183.

Adam, E. K. and Gunnar, M. R. (2001). Relationship Functioning and Home and Work Demands Predict Individual Differences in Diurnal Cortisol Patterns in Women. *Psychoneuroendocrinology* 26 (2), pp.189-208.

Adams, R. B. and Kleck, R. E. (2003). Perceived Gaze Direction and the Processing of Facial Displays of Emotion. *Psychological Science* 14 (6), pp.644-647.

Adams, R. B. and Kleck, R. E. (2005). Effects of Direct and Averted Gaze on the Perception of Facially Communicated Emotion. *Emotion* 5 (1), pp.3-11.

Ader, R. and Cohen, N. (1975). Behaviorally conditioned immunosuppression. *Psychosomatic Medicine* 37, pp.333-340.

Ader, R. and Kelley, K. W. (2007). A Global View of Twenty Years of Brain, Behavior, and Immunity. *Brain, Behavior & Immunity* 21 (1), pp.20-22.

Adolphs, R. (2003). Cognitive neuroscience of human social behaviour. *Nature Reviews Neuroscience* 4 (3), pp.165-180.

Aggleton, P. (1990). *Health.* Society Now. London: Routledge.

Albright, C. R. (2010). James B. Ashbrook and His Holistic World: Toward a "Unified Field Theory" of Mind, Brain, Self, World and God. *Zygon* 45 (2), pp.479-489.

Alexander, S. (1920). *Space, Time, and Deity.* London: Macmillan.

Allison, T. *et al.* (1994). Face Recognition in Human Extrastriate Cortex. *Journal of Neurophysiology* 71 (2), pp.821-825.

Anderson D, D. G., Jobin J. (1996). Social Support, Social Networks and Coronary Artery Disease Rehabilitation: a review. *Canadian Journal of Cardiology* 12 (8), pp.739-744.

Antoni, M. H. and Lutgendorf, S. (2007). Psychosocial Factors and Disease Progression in Cancer. *Current Directions in Psychological Science* 16 (1), pp.42-46.

Arbib, M. A. and Rizzolatti, G. (1997). Neural Expectations: a Possible Evolutionary Path from Manual Skills to Language. *Communication and Cognition* 29 (3-4), pp.393-424.

Ashbrook, J. B. (1984a). *The Human Mind and the Mind of God: Theological Promise in Brain Research.* Lanham, MD: University Press of America

Ashbrook, J. B. (1984b). Neurotheology: The Working Brain and the Work of Theology. *Zygon* 19 (3), pp.331-350.

Ashbrook, J. B. (1989). The Whole Brain as the Basis or the Analogical Expression of God. *Zygon* 24 (1), pp.65-81.

Ashbrook, J. B. (1996a). Making Sense of God: How I Got to the Brain. *Zygon* 31 (3), pp.401-420.

Ashbrook, J. B. (1996b). A Rippling Relatableness in Reality. *Zygon* 31 (3), pp.469-482.

Ashbrook, J. B. (1996c). Toward a New Creation of Being. *Zygon* 31 (3), pp.385-399.

Ashbrook, J. B. and Albright, C. R. (1997). *The Humanizing Brain: Where Religion and Neuroscience Meet.* Cleveland, OH: The Pilgrim Press.

Ashbrook, J. B. and Albright, C. R. (1999). The Humanizing Brain: An Introduction. *Zygon* 34 (1), pp.7-43.

Atkins, P. (2006). Atheism and Science. In: Clayton, P. and Simpson, Z. (eds.) *The Oxford Handbook of Religion and Science*. Oxford: OUP, pp.124-136.

Atkinson, A. P., Tunstall, M. L. and Dittrich, W. H. (2007). Evidence for Distinct Contributions of Form and Motion Information to the Recognition of Emotions from Body Gestures. *Cognition* 104 (1), pp.59-72.

Avitsur, R., Stark, J. L. and Sheridan, J. F. (2001). Social Stress Induces Glucocorticoid Resistance in Subordinate Animals. *Hormones and Behavior* 39 (4), pp.247-257.

Baldwin, M. W. (1992). Relational Schemas and the Processing of Social Information. *Psychological Bulletin* 112 (3), pp.461-484.

Banks, W. A. (2005). Blood-Brain Barrier Transport of Cytokines: A Mechanism for Neuropathology. *Current Pharmaceutical Design* 11 (8), pp.973-984.

Barbour, I. G. (1990). *Religion in an Age of Science (Gifford Lectures 1989-91, Vol 1).* London: SCM.

Bardi, L., Regolin, L. and Simion, F. (2011). Biological Motion Preference in Humans at Birth: Role of Dynamic and Configural Properties. *Developmental Science* 14 (2), pp.353-359.

Barnett, R. C., Steptoe, A. and Gareis, K. C. (2005). Marital-Role Quality and Stress-Related Psychobiological Indicators. *Annals of Behavioral Medicine* 30 (1), pp.36-43.

Baron-Cohen, S. and Wheelwright, S. (2001). The 'Reading the Mind in the Eyes' Test Revised Version: A Study with Normal Adults, and Adults with Asperger Syndrome or High-functioning Autism. *Journal of Child Psychology and Psychiatry* 42 (2), pp.241-251.

Baron, R. *et al.* (1990). Social Support and Immune Function Among Spouses of Cancer Patients. *J. Pers. Soc. Psychology* 59 (344-52).

Barr, J. (1994). *Biblical Faith and Natural Theology: the Gifford Lectures for 1991.* Reprint Ed. Oxford: Oxford University Press.

Barrera, M., Jr (2000). Social Support Research in Community Psychology. In: Rappaport, J. and Seidman, E. (eds.) *Handbook of Community Psychology*. New York: Kluwer Academic/Plenum, pp.215-245.

Barresi, J. and Moore, C. (1996). Intentional Relations and Social Understanding. *Behavioral and Brain Sciences* 19 (01), pp.107-122.

Barth, K. (1958a). *Church Dogmatics III/2. The Doctrine of Creation* Edinburgh: T & T Clark.

Barth, K. (1958b). *Church Dogmatics III/l.* Edinburgh: T & T Clark.

Bartrop, R. *et al.* (1997). Depressed Lymphocyte Function after Bereavement. *The Lancet* 1, pp.374-377.

Bassett, D. S. and Bullmore, E. (2006). Small-World Brain Networks. *The Neuroscientist* 12 (6), pp.512-523.

Bauer, S., Kerr, B. J. and Patterson, P. H. (2007). The Neuropoietic Cytokine Family in Development, Plasticity, Disease and Injury. *Nature Reviews Neuroscience* 8 (3), pp.221-232.

Beattie, T. (2006). *New Catholic Feminism: Theology and Theory.* London: Routledge.

Beauchamp, M. S. *et al.* (2003). fMRI Responses to Video and Point-Light Displays of Moving Humans and Manipulable Objects. *Journal of Cognitive Neuroscience* 15 (7), pp.991-1001.

Bechtel, W. and Stufflebeam, R., S (2001). Epistemic Issues in Procuring Evidence about the Brain: The Importance of Research Instruments and Tech-

niques. In: Bechtel, W. *et al.* (eds.) *Philosophy and the Neurosciences: A Reader*. Oxford: Blackwell Publishers, pp.55-81.
Bedau, M. A. (1997). Weak Emergence. *Noûs* 31, pp.375-399.
Bennett, P. (2009). Towards a Neurotheology of Health: A Transdisciplinary Exploration of Personal Relatedness, Emergence and PNI Function. *Transdisciplinarity in Science and Religion* 5, pp.297-334.
Bennett, P. (2012). Supple and Subtle: John Polkinghorne's Engagement with Reality. In: Watts, F. N. and Knight, C. C. (eds.) *God and the Scientist: Exploring the Work of John Polkinghorne*. Farnham: Ashgate, pp.175-196.
Bennett, P. H. (In Press). Life Beyond Critical Realism: Developing van Huyssteen's Transversal Approach to the Science/theology Dialogue In: Evers, D. *et al.* (eds.) *What is Life? (Issues in Science and Theology Vol 7)*. Edinburgh: T&T Clark.
Berkman, L. F. (1995). The Role of Social Relations in Health Promotion. *Psychosomatic Medicine* 57 (3), pp.245-254.
Berkman, L. F. and Glass, T. (2000). Social Integration, Social networks, Social Support, and Health. In: Berkman, L. F. and Kawachi, I. (eds.) *Social Epidemiology*. Oxford: Oxford University Press, pp.137 - 173.
Berkman, L. F. *et al.* (2000). From Social Integration to Health: Durkheim in the New Millennium. *Social Science & Medicine* 51 (6), pp.843-857.
Berkman, L. F. and Kawachi, I. (2000). A Historical Framework for Social Epidemiology. In: Berkman, L. F. and Kawachi, I. (eds.) *Social Epidemiology*. Oxford: OUP.
Berkman, L. F., Leo-Summers, L. and Horwitz, R. I. (1992). Emotional Support and Survival after Myocardial Infarction. *Annals of Internal Medicine* 117 (12), pp.1003-1009.
Berkman, L. F. and Syme, S. L. (1979). Social Networks, Host Resistance and Mortality: A Nine-Year Follow-Up Study of Alameda County Residents. *American Journal of Epidemiology* 109 (2), pp.186-204.
Berkouwer, G. C. (1962). *Man: The Image of God.* Grand Rapids: Eerdmans.
Bickhard, M. (2003). Process and Emergence: Normative Function and Representation. In: Seibt, J. (ed.) *Process Theories: Crossdisciplinary Studies in Dynamic Categories*. Dordrecht: Kluwer Academic, pp.121-155.
Bickhard, M. (2008). Issues in Process Metaphysics. *Ecological Psychology* 20 (3), pp.252-256.
Bickhard, M. (2009). The Interactivist Model. *Synthese* 166 (3), pp.547-591.
Bird, P. A. (1981). "Male and Female He Created Them": Gen 1:27b in the Context of the Priestly Account of Creation. *The Harvard Theological Review* 74 (2), pp.129-159.
Blair, R. J. R. (2003). Facial Expressions, Their Communicatory Functions and Neuro-Cognitive Substrates. *Philosophical Transactions: Biological Sciences* 358 (1431), pp.561-572.
Blakemore, S. and Decety, J. (2001). From the Perception of Action to the Understanding of Intention. *Nature Reviews Neuroscience* 2 (8), pp.561-567.
Blaxter, M. (2001). What is Health? In: Davey, B., Gray, A. and Seale, C. (eds.) *Health and Disease: A Reader*. Buckingham; Philadelphia: Open University Press, pp.21-27.
Blazer, D. G. (1982). Social Support and Mortality in an Elderly Community Population. *American Journal of Epidemiology* 115 (5), pp.684-694.
Block, N. E. D. (2003). Do Causal Powers Drain Away? *Philosophy and Phenomenological Research* 67 (1), pp.133-150.

Blomkvist, V. *et al.* (1994). Psychosocial Self-prognosis in Relation to Mortality and Morbidity in Hemophiliacs with HIV Infection. *Psychotherapy and Psychosomatics* 62 (3-4), pp.185-192.

Boff, L. (2000). *Holy Trinity, Perfect Community.* Trans. Ed. Maryknoll: Orbis.

Bonaccorso, S., N. and Sturchio, J., L. (2002). For and Against: Direct to Consumer Advertising is Medicalising Normal Human Experience: Against. *BMJ* 324 (7342), pp.910-911.

Bonita, R., Beaglehole, R. and Kjellström, T. (2006). *Basic Epidemiology.* Geneva: WHO.

Borrell-Carrio, F., Suchman, A. L. and Epstein, R. M. (2004). The Biopsychosocial Model 25 Years Later: Principles, Practice, and Scientific Inquiry. *Annals of Family Medicine* 2 (6), pp.576-582.

Brietzke, E. and Kapczinski, F. (2008). TNF-[alpha] as a Molecular Target in Bipolar Disorder. *Progress in Neuro-Psychopharmacology and Biological Psychiatry* 32 (6), pp.1355-1361.

Broad, C. D. (1925). *The Mind and its Place in Nature.* London: Routledge & Kegan Paul.

Broadbent, E. *et al.* (2003). Psychological Stress Impairs Early Wound Repair Following Surgery. *Psychosomatic Medicine* 65 (5), pp.865-869.

Broadbent, E. *et al.* (2012). A Brief Relaxation Intervention Reduces Stress and Improves Surgical Wound Healing Response: A Randomised Trial. *Brain, Behavior, and Immunity* 26 (2), pp.212-217.

Brooke, J. H. (1991). *Science and Religion: Some Historical Perspectives.* Cambridge: CUP.

Brooke, J. H. and Cantor, G. (1998). *Reconstructing Nature: The Engagement of Science and Religion.* Edinburgh: T&T Clark.

Brothers, L. (1990/2002). The Social Brain: a Project for Integrating Primate Behaviour and Neurophysiology in a New Domain. In: Cacioppo, J. T. (ed.) *Foundations in Social Neuroscience*. Cambridge, Mass.: MIT Press, pp.367-385.

Brothers, L. (2002a). A Neuroscientific Perspective on Human Sociality. In: Russell, R. J. *et al.* (eds.) *Neuroscience and the Person: Scientific Perspectives on Divine Action*. Vatican City: Vatican Observatory Publications, pp.67-74.

Brothers, L. (2002b). The Trouble with Neurobiological Explanations of Mind. *Psychoanalytic Inquiry* 22 (5), pp.857-870.

Brown, D. (1994). *Boundaries of Our Habitations: Tradition and Theological Construction.* Albany: State University of New York Press.

Brown, J. R. (2001). *Who Rules in Science? An Opinionated Guide to the Wars.* Cambridge MA: Harvard University Press.

Brown, W. S., Murphy, N. and Maloney, H. N. (eds.) (1998). *Whatever Happened to the Soul? Scientific and Theological Portraits of Human Nature.* Minneapolis: Fortress Press.

Browning, D. (2007). The Thickness of Experience, Religion, and the Varieties of Science. *Zygon* 42 (4), pp.821-824.

Bruckner, J. K. (2005). A Theological Description of Human Wholeness in Deuteronomy 6. *Ex auditu* 21, pp.1-19.

Bryson, K. A. (2008). Editorial Foreward *In, Sweetman, B. The Vision of Gabriel Marcel: Epistemology, Human Person, the Transcendent*. Amsterdam: Rodopi B.V., pp.xi-xiv.

Buccino, G. *et al.* (2001). Action Observation Activates Premotor and Parietal Areas in a Somatotopic Manner: an fMRI Study. *European Journal of Neuroscience* 13 (2), pp.400-404.

Buccino, G. *et al.* (2004). Neural Circuits Involved in the Recognition of Actions Performed by Nonconspecifics: An fMRI Study. *Journal of Cognitive Neuroscience* 16 (1), pp.114-126.

Bulgakov, S. (1933/2008). *The Lamb of God: On the Divine Humanity.* Translated Ed. Grand Rapids: Eerdmans.

Bullmore, E. and Sporns, O. (2009). Complex Brain Networks: Graph Theoretical Analysis of Structural and Functional Systems. *Nat Rev Neurosci* 10 (3), pp.186-198.

Burgoyne, R. W. (2005). Exploring Direction of Causation between Social Support and Clinical Outcome for HIV-positive Adults in the Context of Highly Active Antiretroviral Therapy. *AIDS Care* 17 (1), pp.111-124.

Burklund, L. J., Eisenberger, N. I. and Lieberman, M. D. (2007). The Face of Rejection: Rejection Sensitivity Moderates Dorsal Anterior Cingulate Activity to Disapproving Facial Expressions. *Social Neuroscience* 2 (3/4), pp.238-253.

Busch, T. W. (1995). Secondary Reflection as Interpretation. *Bulletin de la Société Américaine de Philosophie de Langue Française* VII (1-2), pp.176-183.

Bushnell, I. W. R. (2001). Mother's Face Recognition in Newborn Infants: Learning and Memory. *Infant & Child Development* 10 (1/2), pp.67-74.

Butler, A. B. and Hodos, W. (2005). *Comparative Vertebrate Neuroanatomy: Evolution and Adaptation.* Hoboken, NJ: Wiley and Sons.

Byrne, B. (2000). *The Hospitality of God: A Reading of Luke's Gospel.* Collegeville: The Liturgical Press.

Cacioppo, J. T., Hawkley, L. C. and Berntson, G. G. (2003). The Anatomy of Loneliness. *Current Directions in Psychological Science* 12 (3), pp.71-74.

Cacioppo, J. T. *et al.* (2002). Loneliness and Health: Potential Mechanisms. *Psychosomatic Medicine* 64 (3), pp.407-417.

Cacioppo, J. T. *et al.* (2006). Loneliness within a Nomological Net: An Evolutionary Perspective. *Journal of Research in Personality* 40 (6), pp.1054-1085.

Cacioppo, J. T. *et al.* (2009). In the Eye of the Beholder: Individual Differences in Perceived Social Isolation Predict Regional Brain Activation to Social Stimuli. *Journal of Cognitive Neuroscience* 21 (1), pp.83-92.

Calder, A. J. *et al.* (2000). Impaired Recognition and Experience of Disgust Following Brain Injury. *Nature Neuroscience* 3 (11), pp.1077-1078.

Campbell, R. and Bickhard, M. (2011). Physicalism, Emergence and Downward Causation. *Axiomathes* 21 (1), pp.33-56.

Canolty, R. T. *et al.* (2006). High Gamma Power Is Phase-Locked to Theta Oscillations in Human Neocortex. *Science* 313 (5793), pp.1626-1628.

Capuron, L. and Miller, A. H. (2011). Immune System to Brain Signaling: Neuropsychopharmacological Implications. *Pharmacology & Therapeutics* 130 (2), pp.226-238.

Carrington, S. J. and Bailey, A. J. (2009). Are There Theory of Mind Regions in the Brain? A Review of the Neuroimaging Literature. *Human Brain Mapping* 30 (8), pp.2313-2335.

Cassel, J. (1976). The Contribution of the Social Environment to Host Resistance. *American Journal of Epidemiology* 104 (2), pp.107-123.

Castelli, F. *et al.* (2000). Movement and Mind: A Functional Imaging Study of Perception and Interpretation of Complex Intentional Movement Patterns. *Neuroimage* 12 (3), pp.314-325.

Chamberlain, T. J. and Hall, C. (2000). *Realized Religion.* Philadelphia: Templeton Foundation Press.

Champagne, F. A. (2010a). Early Adversity and Developmental Outcomes: Interaction Between Genetics, Epigenetics, and Social Experiences Across the Life Span. *Perspectives on Psychological Science* 5 (5), pp.564-574.

Champagne, F. A. (2010b). Epigenetic Influence of Social Experiences Across the Lifespan. *Developmental Psychobiology* 52 (4), pp.299-311.

Champagne, F. A. (2013). Epigenetics and Developmental Plasticity Across Species. *Developmental Psychobiology* 55 (1), pp.33-41.

Champagne, F. A. and Mashoodh, R. (2009). Genes in Context: Gene-environment Interplay and the Origins of Individual Differences in Behavior. *Current Directions in Psychological Science* 18 (3), pp.127-131.

Chida, Y. and Vedhara, K. (2009). Adverse Psychosocial Factors Predict Poorer Prognosis in HIV Disease: A Meta-analytic Review of Prospective Investigations. *Brain, Behavior, and Immunity* 23 (4), pp.434-445.

Clayton, P. (2006). *Mind and Emergence: From Quantum to Consciousness.* PB Ed. Oxford: OUP.

Clayton, P. (2008). Introduction. In: Clayton, P. and Simpson, Z. (eds.) *The Oxford Handbook of Religion and Science*. PBK ed. Oxford: OUP, pp.1-4.

Clayton, P. and Simpson, Z. (eds.) (2008). *The Oxford Handbook of Religion and Science.* Oxford: OUP.

Coakley, S. (2002). *Powers and Submissions: Spirituality, Philosophy and Gender.* Oxford: Blackwell.

Cobb, S. (1976). Presidential Address-1976. Social Support as a Moderator of Life Stress. *Psychosomatic Medicine* 38 (5), pp.300-314.

Cohen, A. L. *et al.* (2008). Defining Functional Areas in Individual Human Brains Using Resting Functional Connectivity MRI. *NeuroImage* 41 (1), pp.45-57.

Cohen, S. (1988). Psychosocial Models of the Role of Social Support in the Etiology of Physical Disease. *Health Psychology* 7 (3), pp.269-297.

Cohen, S. (2005). The Pittsburgh Common Cold Studies: Psychosocial Predictors of Susceptibility to Respiratory Infectious Illness. *International Journal of Behavioral Medicine* 12 (3), pp.123-131.

Cohen, S. and Janicki-Deverts, D. (2009). Can We Improve Our Physical Health by Altering Our Social Networks? *Perspectives on Psychological Science* 4 (4), pp.375-378.

Cohen, S. and Wills, T. A. (1985). Stress, Social Support, and the Buffering Hypothesis. *Psychological Bulletin* 98 (2), pp.310-357.

Colantonio, A. *et al.* (1993). Psychosocial Predictors of Stroke Outcomes in an Elderly Population. *The Journal of Gerontology* 48 (5), pp.S261-S268.

Cole, S. W., Kemeny, M.E., (2001). Psychosocial Influences on the Progression of HIV Infection. In: Ader, R., Felten, D. L. and Cohen, N. (eds.) *Psychoneuroimmunology*. 3rd Ed. San Diego: Academic Press, pp.583-612.

Cole, S. W. *et al.* (2012). Transcriptional Modulation of the Developing Immune System by Early Life Social Adversity. *PNAS* 109 (50), pp.20578-20583.

Coles, A. (2008). God, Theologian and Humble Neurologist. *Brain* 131 (7), pp.1953-1959.

Coltheart, M. (2006). What has Functional Neuroimaging Told Us About the Mind (so far)? *Cortex* 42 (3), pp.323-331.

Condon, W. S. and Ogston, W. D. (1966). Sound Film Analysis of Normal and Pathological Behavior Patterns. *Journal of Nervous and mental Disease* 143 (4), pp.338-347.

Conty, L. *et al.* (2007). When Eye Creates the Contact! ERP Evidence for Early Dissociation between Direct and Averted Gaze Motion Processing. *Neuropsychologia* 45 (13), pp.3024-3037.

Corning, P. A. (2002). The Re-Emergence of "Emergence": A Venerable Concept in Search of a Theory. *Complexity* 7 (6), pp.18-30.

Costanzo, E. S. *et al.* (2005). Psychosocial Factors and Interleukin-6 Among Women with Advanced Ovarian Cancer. *Cancer* 104 (2), pp.305-313.

Coyne, J. C. *et al.* (2001). Prognostic Importance of Marital Quality for Survival of Congestive Heart Failure. *The American journal of cardiology* 88 (5), pp.526-529.

Craik, F. I. M. and Bialystok, E. (2006). Cognition Through the Lifespan: Mechanisms of Change. *Trends in Cognitive Sciences* 10 (3), pp.131-138.

Crammer, C. (2004). One Sex or Two? Balthasar's Theology of the Sexes. In: Oakes, E. T. and Moss, D. (eds.) *The Cambridge Companion to Hans Urs von Balthasar*. Cambridge: CUP, pp.93-112.

Crutchfield, J. P. (1994). The Calculi of Emergence: Computation, Dynamics and Induction. *Physica D: Nonlinear Phenomena* 75 (1), pp.11-54.

Csibra, G. (2003). Teleological and Referential Understanding of Action in Infancy. *Philosophical Transactions: Biological Sciences* 358 (1431), pp.447-458.

Cunningham, B. (2001). The Reemergence of 'Emergence'. *Philosophy of Science* 68 (3), pp.S62-S75.

Cunningham, D. S. (1998). *These Three are One: The Practice of Trinitarian Theology.* Oxford: Blackwells.

d'Aquili, E. G. and Newberg, A. B. (1999). *The Mystical Mind: Probing the Biology of Religious Experience* Minneapolis: Fortress.

Dallmayr, F. (1996). Review: Splitting the Difference: Comments on Calvin Schrag. *Human Studies* 19 (2), pp.229-238.

Damasio, A. (1994/2000). *Descartes' Error: Emotion, Reason and the Human Brain.* New York: Quill.

Dantzer, R. and Kelley, K. W. (2007). Twenty Years of Research on Cytokine-induced Sickness Behavior. *Brain, Behavior, and Immunity* 21 (2), pp.153-160.

Dantzer, R. *et al.* (2008). From Inflammation to Sickness and Depression: When the Immune System Subjugates the Brain. *Nat Rev Neurosci* 9 (1), pp.46-56.

Daruna, J. H. (2004). *Introduction to Psychoneuroimmunology.* Burlington, MA;: Elsevier Academic Press.

Darwin, C. (1872/2007). *The Expression of the Emotions in Man and Animals.* Reprinted Ed. Minneapolis: Filiquarian.

Davies, S. T. and Evans, C. S. (2006). Conclusion: The Promise of Kenosis. In: Evans, C. S. (ed.) *Exploring Kenotic Christology: The Self-emptying of God*. Oxford: OUP, pp.313-321.

de Freitas, L., Morin, E. and Nicolescu, B. (1994). *Charter of Transdisciplinarity.*

de Lacoste, G. (1995). Gabriel Marcel's Body-as-a-Subject: A Preeminenently Postmodern Notion *Bulletin de la Société Américaine de Philosophie de Langue Française* VII (1-2), pp.69-82.

De Vogli, R., Chandola, T. and Marmot, M. (2007). Negative Aspects of Close Relationships and Heart Disease. *Archives of Internal Medicine* 167 (18), pp.1951-1957.

De Wolf, T. and Holvoet, T. (2005). Emergence Versus Self-Organisation: Different Concepts but Promising When Combined. In: Brueckner, S. *et al.* (eds.)

Engineering Self-Organising Systems. Vol. 3464. Berlin / Heidelberg: Springer pp.1-15.

Deacon, T. W. (2003). The Hierarchical Logic of Emergence: Untangling the Interdependence of Evolution and Self-organisation. In: Weber, B. and Depew, D. (eds.) *Evolution and Learning: The Baldwin Effect Reconsidered*. Cambridge MA: MIT Press, pp.273-308.

Deacon, T. W. (2007). Three Levels of Emergent Phenomena. In: Murphy, N. and Stoeger, W. R. (eds.) *Evolution and Emergence: Systems, Organisms, Persons*. Oxford: OUP, pp.88-110.

Deacon, T. W. (2012). *Incomplete Nature: How Mind Emerged From Matter.* New York/London: W.W. Norton & Company.

Deane-Drummond, C. (2010). The Breadth of Glory: A Trinitarian Eschatology for the Earth through Critical Engagement with Hans Urs von Balthasar. *International Journal of Systematic Theology* 12 (1), pp.46-64.

Deco, G., Jirsa, V. K. and McIntosh, A. R. (2011). Emerging Concepts for the Dynamical Organization of Resting-state Activity in the Brain. *Nature Reviews Neuroscience* 12 (1), pp.43-56.

Derrida, J. (1973). *Speech and Phenomena: and other Essays on Husserl's Theory of Signs.* Evanston, IL: Northwestern University Press.

Desmond, W. (2003). Philosophies of Religion: Marcel, Jaspers, Levinas. In: Kearney, R. (ed.) *Continental Philosophy in the 20th Century*. Paperback ed. Abingdon: Routledge, pp.131-174.

Després, C., Brais, N. and Avellan, S. (2004). Collaborative Planning for Retrofitting Suburbs: Transdisciplinarity and Intersubjectivity in Action. *Futures* 36 (4), pp.471-486.

Dewey, J. (1938). *Logic, the Theory of Inquiry.* New York: Henry Holt.

Dickerson, S. S. and Kemeny, M. E. (2004). Acute Stressors and Cortisol Responses: A Theoretical Integration and Synthesis of Laboratory Research. *Psychological Bulletin* 130 (3), pp.355-391.

Dickerson, S. S., Gruenewald, T. L. and Kemeny, M. E. (2004a). When the Social Self is Threatened: Shame, Physiology, and Health. *Journal of Personality* 72 (6), pp.1191-1216.

Dickerson, S. S. *et al.* (2004b). Immunological Effects of Induced Shame and Guilt. *Psychosomatic Medicine* 66 (1), pp.124-131.

Dickerson, S. S. *et al.* (2009). Social-Evaluative Threat and Proinflammatory Cytokine Regulation: An Experimental Laboratory Investigation. *Psychological Science* 20 (10), pp.1237-1244.

Ditzen, B., Hoppmann, C. and Klumb, P. (2008). Positive Couple Interactions and Daily Cortisol: On the Stress-protecting Role of Intimacy. *Psychosomatic Medicine* 70 (8), pp.883-889.

Ditzen, B. *et al.* (2007). Effects of Different Kinds of Couple Interaction on Cortisol and Heart Rate Responses to Stress in Women. *Psychoneuroendocrinology* 32 (5), pp.565-574.

Ditzen, B. *et al.* (2009). Intranasal Oxytocin Increases Positive Communication and Reduces Cortisol Levels During Couple Conflict. *Biological Psychiatry* 65 (9), pp.728-731.

Dopp, J. M. *et al.* (2000). Increased Natural Killer-cell Mobilization and Cytotoxicity During Marital Conflict. *Brain, Behavior, and Immunity*, pp.10-26.

Double, D. (2002). The Limits of Psychiatry. *BMJ* 324, pp.900-904.

Downing, P. E. *et al.* (2001). A Cortical Area Selective for Visual Processing of the Human Body. *Science* 293 (5539), pp.2470-2473.

Drees, W. B. (1996). *Religion, Science, and Naturalism.* Cambridge: CUP.

Drees, W. B. (2006). Religious Naturalism and Science. In: Clayton, P. and Simpson, Z. (eds.) *The Oxford Handbook of Religion and Science*. Oxford: OUP, pp.108-123.

Drees, W. B. (2010). *Religion and Science in Context: A Guide to the Debates.* London/New York: Routledge.

Durkheim, E. (1897). *Suicide.* New York: Free Press.

Eaker, E. D. *et al.* (2007). Marital Status, Marital Strain, and Risk of Coronary Heart Disease or Total Mortality: the Framingham Offspring Study. *Psychosomatic Medicine* 69 (6), pp.509-513.

Ebrahim, S. (2002). The Medicalisation of Old Age. *BMJ* 324, pp.861-863.

Einstein, A. (1954). *Ideas and Opinions.* ET Ed. New York: Crown Publishers.

Eisenberger, N. I., Lieberman, M. D. and Williams, K. D. (2003). Does Rejection Hurt? An fMRI Study of Social Exclusion. *Science* 302 (5643), pp.290-292.

Eisenberger, N. I. *et al.* (2007). Neural Pathways Link Social Support to Attenuated Neuroendocrine Stress Responses. *NeuroImage* 35 (4), pp.1601-1612.

Ekman, P., Friesen, W. V. and Ellsworth, P. (1972). *Emotion in the Human Face: Guidelines for Research and an Integration of Findings.* New York: Pergamon press.

Ekman, P. *et al.* (1987). Universals and Cultural Differences in the Judgments of Facial Expressions of Emotion. *Journal of Personality and Social Psychology* 53 (4), pp.712-717.

Ell, K. (1996). Social networks, social support and coping with serious illness: The family connection. *Social Science & Medicine* 42 (2), pp.173-183.

Ell, K. *et al.* (1992). Social Relations, Social Support and Survival Among Patients with Cancer. *Journal of Psychosomatic Research* 36 (6), pp.531-541.

Ellis, G. (2001). Kenosis as a Unifying Theme for Life and Cosmology. In: Polkinghorne, J. (ed.) *The Work of Love. Creation as Kenosis*. Grand Rapids/London: Eerdmans/SPCK, pp.107-126.

Ellis, G. F. R. (2008). On the Nature of Causation in Complex Systems. *Transactions of the Royal Society of South Africa* 63 (1), pp.69 - 84.

Ellis, H. D., Bruce, V. and Schonen, S. D. (1992). The Development of Face Processing Skills [and Discussion]. *Philosophical Transactions: Biological Sciences* 335 (1273), pp.105-111.

Emerson, R. W. (1860/2004). *The Conduct of Life.* Google Books Ed: Kessinger Publishing.

Engel, G. L. (1977). The Need for a New Medical Model: A Challenge for Biomedicine. *Science* 196 (4286), pp.129-136.

Esterling, B. A. *et al.* (1990). Emotional Repression, Stress Disclosure Responses, and Epstein-Barr Viral Capsid Antigen Titers. *Psychosomatic Medicine* 52, pp.397 - 410.

Esterling, B. A., Kiecolt-Glaser JK and Glaser, R. (1994). Psychosocial Modulation of Cytokine-Induced Natural Killer Cell Activity in Older Adults. *Psychosomatic Medicine* 58, pp.264-272.

Evans, R. L. *et al.* (1987). Pre-stroke Family Interaction as a Predictor of Stroke Outcome. *Arch Phys Med Rehabil.*

Ewart, C. K. *et al.* (1991). High Blood Pressure and Marital Discord: Not Being Nasty Matters More Than Being Nice. *Health Psychology* 10 (3), pp.155-163.

Falck-Ytter, T., Gredeback, G. and von Hofsten, C. (2006). Infants Predict Other People's Action Goals. *Nature Neuroscience* 9 (7), pp.878-879.

Farroni, T. *et al.* (2005). Newborns' Preference for Face-relevant Stimuli: Effects of Contrast Polarity. *PNAS* 102 (47), pp.17245-17250.

Farroni, T. *et al.* (2007). Direct Gaze Modulates Face Recognition in Young Infants. *Cognition* 102 (3), pp.396-404.

Fauci, A. S., Dale, D. C. and Balow, J. E. (1976). Glucocorticosteroid Therapy: Mechanisms of Action and Clinical Considerations. *Annals of Internal Medicine* 84 (3), pp.304-315.

Fetz, E. (1993). Dynamic Neural Network Models of Sensorimotor Behaviour. In: Gardner, D. (ed.) *The Neurobiology of Neural Networks*. Cambridge MA: MIT Press, pp.165-190.

Feyerabend, P. (1975). *Against Method.* London: Verso.

Feyerabend, P. (1987). *Farewell to Reason.* 2nd ed. London: Verso.

Fiddes, P. S. (2000). *Participating in God: a Pastoral Doctrine of the Trinity* London: Darton, Longman & Todd.

Field, T. M. *et al.* (1982). Discrimination and Imitation of Facial Expressions by Neonates. *Science* 218 (4568), pp.179-181.

Fingelkurts, A. and Fingelkurts, A. (2004). Making Complexity Simpler: Multivariability and Metastability in the Brain. *International Journal of Neuroscience* 114 (7), pp.843-862.

Flanagan, J. R. and Johansson, R. S. (2003). Action Plans Used in Action Observation. *Nature* 424 (6950), p.769.

Flexner, A. and Pritchett, H. S. (1910). *Medical Education in the United States and Canada: a Report to the Carnegie Foundation for the Advancement of Teaching.* Carnegie Foundation for the Advancement of Teaching. Bulletin, 4. New York.

Fogassi, L. (2011). The Mirror Neuron System: How Cognitive Functions Emerge from Motor Organization. *Journal of Economic Behavior & Organization* 77 (1), pp.66-75.

Fogassi, L. and Ferrari, P. F. (2007). Mirror Neurons and the Evolution of Embodied Language. *Current Directions in Psychological Science* 16 (3), pp.136-141.

Ford, E. S., Loucks, E. B. and Berkman, L. F. (2006). Social Integration and Concentrations of C-reactive Protein among US Adults. *Annals of Epidemiology* 16 (2), pp.78-84.

Fox, N. and Ward, K. (2006). Health Identities: From Expert Patient to Resisting Consumer. *Health: An Interdisciplinary Journal for the Social Study of Health, Illness and Medicine* 10 (4), pp.461-479.

France, A. (1908). *The Garden of Epicurus.* English Translation Ed. London: The Bodley Head.

Frank, M. C., Vul, E. and Johnson, S. P. (2009). Development of Infants' Attention to Faces During the First Year. *Cognition* 110 (2), pp.160-170.

Friedland J and McColl, M. (1987). Social Support and Psychosocial Dysfunction after Stroke: Buffering Effects in a Community Sample. *Arch Phys Med Rehabil.* 68 (8), pp.475-480.

Friedman, E. M. *et al.* (2005). Social Relationships, Sleep Quality, and Interleukin-6 in Aging Women. *PNAS* 102 (51), pp.18757-18762.

Frischen, A., Bayliss, A. P. and Tipper, S. P. (2007). Gaze Cueing of Attention: Visual Attention, Social Cognition, and Individual Differences. *Psychological Bulletin* 133 (4), pp.694-724.

Frith, C., D. (2007). The Social Brain? *Philosophical Transactions: Biological Sciences* 362 (1480), pp.671-678.

Frith, C. D. and Wolpert, D. M. (2003). Introduction. *Philosophical Transactions: Biological Sciences* 358 (1431), pp.431-434.

Frodeman, R. and Mitcham, C. (2007). New Directions in Interdisciplinarity: Broad, Deep, and Critical. *Bulletin of Science, Technology & Society* 27 (6), pp.506-514.

Fromm, J. (2005). *Types and Forms of Emergence.Nonlinear Sciences e-prints.*

Fulton, A. (2001). *Powers of Congress.* Louisville, KY: Sarabande.

Funch, D. P. and Marshall, J. (1983). The Role of Stress, Social Support and Age in Survival from Breast Cancer. *Journal of Psychosomatic Research* 27 (1), pp.77-83.

Gadamer, H.-G. (1996). *The Enigma of Health: The Art of Healing in a Scientific Age.* English translation Ed. Stanford, California: Stanford University Press.

Gallagher, H. L. and Frith, C. D. (2003). Functional Imaging of `Theory of Mind'. *Trends in Cognitive Sciences* 7 (2), pp.77-83.

Gallagher, H. L. and Frith, C. D. (2004). Dissociable Neural Pathways for the Perception and Recognition of Expressive and Instrumental Gestures. *Neuropsychologia* 42 (13), pp.1725-1736.

Gallese, V. *et al.* (1996). Action Recognition in the Premotor Cortex. *Brain* 119 (2), pp.593-609.

Gallo, L. C. *et al.* (2003). Marital Status, Marital Quality, and Atherosclerotic Burden in Postmenopausal Women. *Psychosomatic Medicine* 65, pp.952-962.

Gardner, L. *et al.* (1999). *Balthasar at the End of Modernity.* Edinburgh: T&T Clark Ltd.

Gava, L. *et al.* (2008). Effect of Partial Occlusion on Newborns Face Preference and Recognition. *Developmental Science* 11 (4), pp.563-574.

Gazzola, V. *et al.* (2007). The Anthropomorphic Brain: The Mirror Neuron System Responds to Human and Robotic Actions. *NeuroImage* 35 (4), pp.1674-1684.

Geertz, A. W. (2009). When Cognitive Scientists Become Religious, Science is in Trouble: On Neurotheology from a Philosophy of Science Perspective. *Religion* 39 (4), pp.319-324.

George, N. and Conty, L. (2008). Facing the Gaze of Others. *Neurophysiologie Clinique/ Clinical Neurophysiology* 38 (3), pp.197-207.

Gerstman, B. B. (2003). *Epidemiology Kept Simple: An Introduction to Classic and Modern Epidemiology.* 2nd Ed. New Jersey: Wiley-Liss.

Glaser, R. *et al.* (1992). Stress-induced Modulation of the Immune Response to Recombinant Hepatitis B Vaccine. *Psychosomatic Medicine* 54 (22-29).

Glass, T. A. *et al.* (1993). Impact of Social Support on Outcome in First Stroke. *Stroke* 24 (1), pp.64-70.

Godfrey, J. J. (1995). The Phenomena of Trusting and Relational Ontologies. *Bulletin de la Société Américaine de Philosophie de Langue Française* VII (1-2), pp.104-121.

Goldberg, D. W. (2009). D'Aquili and Newberg's Neurotheology: A Hermeneutical Problem with their Neurological Solution. *Religion* 39 (4), pp.325-330.

Goldsmith, S. B. (1972). The Status of Health Indicators. *Health Service Reports* 87 (3), pp.212-220.

Goldstein, J. (1999). Emergence as a Construct: History and Issues. *Emergence* 1 (1), pp.49-72.

Goodkin, K. *et al.* (1992). Active Coping Style is Associated with Natural killer Cell Cytotoxicity in Asymptomatic HIV-1 Seropositive Homosexual Men. *Journal of Psychosomatic Research* 36, pp.635-650.

Goren, C. C., Sarty, M., & Wu, P. Y (1975). Visual Following and Pattern Discrimination of Face-Like Stimuli by Newborn Infants. *Pediatrics* 56, pp.544-549.

Gorman, M. J. (2007). "Although/because He was in the Form of God": the Theological Significance of Paul's Master Story (Phil 2:6-11). *Journal of Theological Interpretation* 1 (2), pp.147-169.

Gouin, J.-P. *et al.* (2009). Attachment Avoidance Predicts Inflammatory Responses to Marital Conflict. *Brain, Behavior, and Immunity* 23 (7), pp.898-904.

Gouin, J.-P. *et al.* (2010). Marital Behavior, Oxytocin, Vasopressin, and Wound Healing. *Psychoneuroendocrinology* 35 (7), pp.1082-1090.

Gouin, J.-P. and Kiecolt-Glaser, J. K. (2011). The Impact of Psychological Stress on Wound Healing: Methods and Mechanisms. *Immunology and Allergy Clinics of North America* 31 (1), pp.81-93.

Graf, F. W. (2007). God's Brain. Some Critical Remarks on Modern Neurotheology. *European Review* 15 (2), pp.257-264.

Graham, J. E. *et al.* (2009). Cognitive Word Use During Marital Conflict and Increases in Proinflammatory Cytokines. *Health Psychology* 28 (5), p.621.

Graunt, J. (1662/1939). *Natural and Political Observations Mentioned in a Following Index, and Made upon the Bills of Mortality.* Reprint Ed. London/Baltimore: John Hopkins University Press.

Greenberg, V. D. (1990). *Transgressive Readings: The Texts of Franz Kafka and Max Planck.* Ann Arbor: University of Michigan Press.

Greenfield, L., L. (1996). Ashbrook as Neurotheologian. *Zygon* 31 (3), pp.457-462.

Gregersen, N. H. and van Huyssteen, J. W. (eds.) (1998a). *Rethinking Theology and Science. Six Models for the Current Dialogue.* Grand Rapids/Cambridge: Eerdmans

Gregersen, N. H. and Van Huyssteen, J. W. (1998b). Theology and Science in a Pluralist World: An Introduction. In: Gregersen, N. H. and Van Huyssteen, J. W. (eds.) *Rethinking Theology and Science: Six Models for the Current Dialogue*. Grand Rapids: Eerdmans, pp.1-11.

Grenz, S. J. (2001). *The Social God and the Relational Self: A Trinitarian Theology of the Imago Dei.* Louisville, Kentucky: Westminster John Knox Press.

Grenz, S. J. (2004). *Rediscovering the Triune God: The Trinity in Contemporary Theology.* Minneapolis: Fortress Press.

Grewen, K. M. *et al.* (2005). Effects of Partner Support on Resting Oxytocin, Cortisol, Norepinephrine, and Blood Pressure Before and After Warm Partner Contact. *Psychosomatic Medicine* 67 (4), pp.531-538.

Gross, P. R. and Levitt, N. (1994). *Higher Superstition: The Academic Left and Its Quarrels With Science.* Baltimore: John Hopkinns University Press.

Grossman, E. D. and Blake, R. (2002). Brain Areas Active during Visual Perception of Biological Motion. *Neuron* 35 (6), pp.1167-1175.

Grossman, E. D., Jardine, N. L. and Pyles, J. A. (2010). Fmr-Adaptation Reveals Invariant Coding of Biological Motion on the Human STS. *Frontiers in Human Neuroscience* 4, p.1-18.

Gruenewald, T. L., Kemeny, M. E. and Aziz, N. (2006). Subjective Social Status Moderates Cortisol Responses to Social Threat. *Brain, Behavior, and Immunity* 20 (4), pp.410-419.

Gunton, C. (1991). Trinity, Ontology and Anthropology: Towards a Renewal of the Doctrine of the Imago Dei. In: Schwobel, C. and Gunton, C. (eds.) *Persons, Divine and Human*. Edinburgh: T and T Clark, pp.47-64.

Gunton, C. E. (1995). Relation and Relativity. In: Schwobel, C. (ed.) *Trinitarian Theology Today: Essays on Divine Being and Action*. Edinburgh: T&T Clark, pp.92-112.

Gunton, C. E. (1997). *The Promise of Trinitarian Theology.* 2nd Ed. Edinburgh: T&TClark.

Haack, S. (2007). *Defending Science - within Reason: Between Scientism And Cynicism* Kindle Ed. Prometheus

Haack, S. (2009). *Evidence and Inquiry: A Pragmatist Reconstruction of Epistemology.* Expanded (Kindle) Ed. Prometheus.

Hackett, R. A. *et al.* (2012). Loneliness and Stress-Related Inflammatory and Neuroendocrine Responses in Older Men and Women. *Psychoneuroendocrinology* 37 (11), pp.1801-1809.

Halley, J. D. and Winkler, D. A. (2008). Classification of Emergence and its Relation to Self-organization. *Complexity* 13 (5), pp.10-15.

Hanley, K. R. (1995). Gabriel Marcel and Postmodernism: Reflections on a Broken World. *Bulletin de la Société Américaine de Philosophie de Langue Française* VII (1-2), pp.122-147.

Hanley, K. R. (1998). Translator's Preface to *Gabriel Marcel's Perspectives on the Broken World*. Milwaukee: Marquette University Press, pp.13-30.

Hanson, P. D. (1984). War and Peace in the Hebrew Bible. *Interpretation* 38 (4), pp.341-362.

Hansson, G. K. (2005). Mechisms of Disease: Inflammation, Atherosclerosis, and Coronary Artery Disease. *New England Journal of Medicine* 352 (16), pp.1685-1696.

Hardcastle, V. G. and Stewart, C. M. (2002). What Do Brain Data Really Show? *Philosophy of Science* 69 (3), pp.S72-S82.

Harris, T. B. *et al.* (1999). Associations of Elevated Interleukin-6 and C-reactive Protein levels with Mortality in the Elderly. *American Journal of Medicine* 106 (5), pp.506-512.

Harrison, P. (2008). Religion, the Royal Society, and the Rise of Science. *Theology & Science* 6 (3), pp.255-271.

Harrison, P. (2010). Introduction. In: Harrison, P. (ed.) *The Cambridge Companion to Science and Religion*. Cambridge: CUP, pp.1-18.

Hart, G. and Wellings, K. (2002). Sexual Behaviour and its Medicalisation in Sickness and Health. *BMJ* 324, pp.896-900.

Haught, J. (1995). *Science & Religion: From Conflict to Conversation.* New York: Paulist Press.

Haurewas, S. (1993). *Naming The Silences.* Edinburgh: T & T Clark.

Hawkley, L. C. *et al.* (2003). Loneliness in Everyday Life: Cardiovascular Activity, Psychosocial Context, and Health Behaviors. *Journal of Personality and Social Psychology* 85 (1), pp.105-120.

Hawkley, L. C. *et al.* (2007). Loneliness, Dysphoria, Stress and Immunity: A Role for Cytokines. In: Plotnikof, N. P., Faith, T. R. F. and Murgo, A. J. (eds.) *Cytokines: Stress and Immunity*. Bocan Raton, LA: CRC Press, pp.67-86

Hawkley, L. C. and Cacioppo, J. T. (2003). Loneliness and Pathways to Disease. *Brain, Behavior, and Immunity* 17 (1, Supplement 1), pp.98-105.

Hawkley, L. C. and Cacioppo, J. T. (2010). Loneliness Matters: a Theoretical and Empirical Review of Consequences and Mechanisms. *Annals of Behavioral Medicine* 40 (2), pp.218-227.

Hayley, S. and Anisman, H. (2005). Multiple Mechanisms of Cytokine Action in Neurodegenerative and Psychiatric States: Neurochemical and Molecular Substrates. *Current Pharmaceutical Design* 11 (8), pp.947-962.

Heffner, K. L. *et al.* (2006). Older Spouses' Cortisol Responses to Marital Conflict: Associations with Demand/Withdraw Communication Patterns. *Journal of Behavioral Medicine* 29 (4), pp.317-325.

Hefner, P. (1984). The Creation. In: Braaten, C. E. and Jenson, R. W. (eds.) *Christian Dogmatics*. Philadelphia: Fortress.

Hefner, P. (1985). The Human Mind and the Mind of God: Theological Promise in Brain Research (Review). *Zygon* 20 (3), pp.345-349.

Hefner, P. (1993). *The Human Factor: Evolution, Culture and Creation.* Minneapolis: Fortress.

Hefner, P. *et al.* (2010). Zygon and the Future of Religion-and-Science. *Zygon* 45 (2), pp.419-522.

Hehn, J. (1915). Zum Terminus "Bild Gottes"*Festschrift Eduard Sachau zum siebzigsten Geburtstag*. Berlin: G Reimer.

Heidegger, M. (1962). *Being and Time.* ET Ed. Oxford: Blackwell.

Helman, C. G. (2007). *Culture, Health and Illness.* 5th ed. London: Hodder Arnold.

Helminiak, D. A. (2010). “Theistic Psychology and Psychotherapy": A Theological and Scientific Critique. *Zygon* 45 (1), pp.47-74.

Herzfeld, N. (2002). *In Our Image: Artificial Intelligence and the Human Spirit.* Minneapolis: Fortress.

Heylighen, F. (1989). Self-organization, Emergence and the Architecture of Complexity. In: *Proceedings of the 1st European Conference on System Science*. AFCET, Paris.

Hoffman-Goetz, L. and Pedersen, B. K. (1994). Exercise and the Immune System: a Model of the Stress Response? *Immunolgy Today* 15, pp.382 - 387.

Hoffman, E. A. and Haxby, J. V. (2000). Distinct Representations of Eye Gaze and Identity in the Distributed Human Neural System for Face Perception. *Nature Neuroscience* 3 (1), pp.80-84.

Holt-Lunstad, J., Birmingham, W. and Jones, B. Q. (2008). Is There Something Unique About Marriage? The Relative Impact of Marital Status, Relationship Quality, and Network Social Support on Ambulatory Blood Pressure and Mental Health. *Annals of Behavioral Medicine* 35 (2), pp.239-244.

Holt-Lunstad, J., Smith, T. B. and Layton, J. B. (2010). Social Relationships and Mortality Risk: A Meta-analytic Review. *PLoS Med* 7 (7), p.e1000316.

Hong, D. S., Angelo, L. S. and Kurzrock, R. (2007). Interleukin-6 and its Receptor in Cancer. *Cancer* 110 (9), pp.1911-1928.

Hood, B. M. *et al.* (2003). Eye Remember You: The Effects of Gaze Direction on Face Recognition in Children and Adults. *Developmental Science* 6 (1), pp.67-71.

Horlick-Jones, T. and Sime, J. (2004). Living on the Border: Knowledge, Risk and Transdisciplinarity. *Futures* 36 (4), pp.441-456.

Horrell, J. S. (2004). Toward a Biblical Model of the Social Trinity: Avoiding Equivocation of Nature and Order *Journal of the Evangelical Theological Society* 47 (3), pp.399-421.

House, J. S. (1981). *Work Stress and Social Support.* Reading, MA: Addison-Wesley.

House, J. S., Landis, K. R. and Umberson, D. (1988). Social Relationships and Health. *Science* 241 (4865), pp.540-545.

House, J. S., Robbins, C. and Metzner, H. L. (1982). The Association of Social Relationships and Activities with Mortality: Prospective Evidence from the Tecumseh Community Health Study. *American Journal of Epidemiology* 116 (1), pp.123-140.

Hurley, S. and Chater, N. (eds.) (2005). *Perspectives on Imitation: From Neuroscience to Social Science. Vol 2 Imitation, Human Development and Culture.* Cambridge Mass.: MIT Press.

Huxley, T. H. (1893/2011). *Collected Essays Volume 3: Science and Education.* Cambridge University Press.

Iacoboni, M. (2008). Mesial Frontal Cortex and Super Mirror Neurons. *Behavioral and Brain Sciences* 31 (1), p.30.

Iacoboni, M. (2009). *Mirroring People.* New York: Picador.

Iacoboni, M. and Dapretto, M. (2006). The Mirror Neuron System and the Consequences of its Dysfunction. *Nat Rev Neurosci* 7 (12), pp.942-951.

Illich, I. (1995). *Limits to Medicine. Medical Nemesis:The Expropriation of Health.* London: Marion Boyars Publishers.

Illich, I. (2001). The Epidemics of Modern Medicine. In: Davey, B., Gray, A. and Seale, C. (eds.) *Health and Disease: A Reader*. Buckingham; Philadelphia: Open University Press, pp.264-269.

Insel, T. R. and Fernald, R. D. (2004). How The Brain Processes Social Information: Searching for the Social Brain. *Annual Review of Neuroscience* 27 (1), pp.697-722.

Irwin, M. R. (2008). Human Psychoneuroimmunology: 20 Years of Discovery. *Brain, Behavior & Immunity* 22 (2), pp.129-139.

Jackelén, A. (2003). Science and Religion: Getting Ready for the Future. *Zygon®* 38 (2), pp.209-228.

Jackelén, A. (2006). Emergence Everywhere?! Reflections on Philip Clayton's Mind and Emergence. *Zygon: Journal of Religion & Science* 41 (3), pp.623-632.

Jackelen, A. (2008). What Theology Can Do for Science. *Theology & Science* 6 (3), pp.287-303.

Jackson, P. L. and Decety, J. (2004). Motor Cognition: a New Paradigm to Study Self-Other Interactions. *Current Opinion in Neurobiology* 14 (2), pp.259-263.

Jackson, P. L., Meltzoff, A. N. and Decety, J. (2005). How Do We Perceive the Pain of Others? A Window into the Neural Processes Involved in Empathy. *NeuroImage* 24 (3), pp.771-779.

Jacob, P. and Jeannerod, M. (2005). The Motor Theory of Social Cognition: a Critique. *Trends in Cognitive Sciences* 9 (1), pp.21-25.

Jacobs, N. (2008). On "Not Three Gods" Again: Can a Primary-Secondary Substance Reading of Ousia and Hypostasis Avoid Tritheism? *Modern Theology* 24 (3), pp.331-358.

Jain, S., Bower, J. and Irwin, M. R. (2012). Psychoneuroimmunology of Fatigue and Sleep Disturbance: The Role of Pro-Inflammatory Cytokines. In: Segerstrom, S. C. (ed.) *The Oxford Handbook of Psychoneuroimmunology*. Oxford: OUP, pp.321-340.

James, W. (1890/1957). *The Principles of Psychology Volume 2.* New York: Dover Publications.

Janke, W. (1999). *Kritik der präzisierten Welt.* Freiburg: Verlag K. Alber.

Jantsch, E. (1972). *Technological Forecasting and Social Futures.* London: Cassell.

Jeeves, M. (2001). The Nature of Persons and the Emergence of Kenotic Behaviour. In: Polkinghorne, J. (ed.) *The Work of Love. Creation as Kenosis*. Grand Rapids/London: Eerdmans/SPCK, pp.66-89.

Jirsa, V. (2004). Connectivity and Dynamics of Neural Information Processing. *Neuroinformatics* 2 (2), pp.183-204.

Johanson, R., Newburn, M. and MacFarlane, A. (2002). Has the Medicalisation of childbirth gone too far. *BMJ* 324 (892-895).

Johansson, G. (1973). Visual Perception of Biological Motion and a Model for its Analysis. *Attention, Perception, & Psychophysics* 14 (2), pp.201-211.

Johansson, G. (1977). Studies on Visual Perception of Locomotion. *Perception* 6 (4), pp.365-376.

Johnson Frey, S. H. *et al.* (2003). Actions or Hand-Objects Interactions? Human Inferior Frontal Cortex and Action Observation. *Neuron* 39 (1053-1058).

Johnson, M. S., Dziurawic, H., Ellis, M., & Morton, J (1991). Newborns' Preferential Tracking of Face-Like Stimuli and its Subsequent Decline. *Cognition* 40, pp.1-19.

Juarrero, A. (2002). *Dynamics in Action: Intentional Behavior as a Complex System.* PBK Ed. Cambridge MA: MIT Press.

Juarrero, A. (2008). On Philosophy's "To Rethink" List: Causality, Explanation, and Ethics. *Ecological Psychology* 20 (3), pp.278-282.

Juarrero, A. (2009). Top-Down Causation and Autonomy in Complex Systems. In: Murphy, N., Ellis, G. and O'Connor, T. (eds.) *Downward Causation and the Neurobiology of Free Will*. Vol. 56. Berlin / Heidelberg: Springer, pp.83-102.

Just, M. A. *et al.* (2004). Cortical Activation and Synchronization During Sentence Comprehension in High-functioning Autism: Evidence of Underconnectivity. *Brain* 127 (8), pp.1811-1821.

Kant, I. (1790/2007). *The Critique of Judgement.* World Classics ed. Oxford: OUP.

Kanwisher, N., McDermott, J. and Chun, M. M. (1997). The Fusiform Face Area: A Module in Human Extrastriate Cortex Specialized for Face Perception. *The Journal of Neuroscience* 17 (11), pp.4302-4311.

Kaplan, G. A. *et al.* (1988). Social Connections and Mortality from all Causes and from Cardiovascular Disease: Prospective Evidence from Eastern Finland. *American Journal of Epidemiology* 128 (2), pp.370-380.

Karo, R. and Friedenthal, M. (2008). *Kenōsis, Anamnēsis,* and Our Place in History: A Neurophenomenological Account. *Zygon* 43 (4), pp.823-836.

Kauffman, J. S. (2008). Social Epidemiology. In: Rothman, K. J., Greenland, S. and Lash, T. L. (eds.) *Modern Epidemiology*. Philadelphia: Lippincott Williams & Wilkins, pp.532-548.

Kauffman, S. A. (1996). *At Home in the Universe: The Search for Laws of Complexity.* PBK Ed. Oxford: OUP.

Kaufman, G. D. (1993). *In the Face of Mystery: A Constructive Theology.* Cambridge: Harvard University Press.

Kawachi, I. *et al.* (1996). A Prospective Study of Social Networks in Relation to Total Mortality and Cardiovascular Disease in Men in the USA. *Journal of Epidemiology & Community Health* 50 (3), pp.245-251.

Kelso, J. A. S. (1995). *Dynamic Patterns: The Self-organization of Brain and Behavior.* Cambridge MA: MIT Press.

Kelso, J. A. S. (2010). Metastable Mind. In: Hauptman, D. and Neidich, W. (eds.) *Cognitive Architecture From Biopolitics to Noopolitics: Architecture and*

Mind in the Age of Communication and Information. Rotterdam: 010 Publishers, pp.116-141.

Kelso, J. A. S. and Tognoli, E. (2006). Metastability in the Brain *2006 IEEE International Joint Conference on Neural Network Proceedings*. New York: IEEE, pp.363-368.

Kemeny, M. E. (2009). Psychobiological Responses to Social Threat: Evolution of a Psychological Model in Psychoneuroimmunology. *Brain, Behavior, and Immunity* 23 (1), pp.1-9.

Kemeny, M. E. and Schedlowski, M. (2007). Understanding the Interaction between Psychosocial Stress and Immune-related Diseases: A Stepwise Progression. *Brain, Behavior, and Immunity* 21 (8), pp.1009-1018.

Kiecolt-Glaser, J. K. and Glaser, R. (1988). Methodological Issues in Behavioral Immunology Research with Humans. *Brain, Behavior & Immunity* 2 (1), pp.67-78.

Kiecolt-Glaser, J. K., Gouin, J.-P. and Hantsoo, L. (2010). Close Relationships, Inflammation, and Health. *Neuroscience & Biobehavioral Reviews* 35 (1), pp.33-38.

Kiecolt-Glaser, J. K. and Newton, T. L. (2001). Marriage and Health: His and Hers. *Psychological Bulletin* 127 (4), p.472.

Kiecolt-Glaser, J. K. *et al.* (1987). Marital Quality, Marital Disruption, and Immune Function. *Psychosomatic Medicine* 49 (1), pp.13-34.

Kiecolt-Glaser, J. K. *et al.* (1991). Spousal Caregivers of Dementia Victims: Longitudinal Changes in Immunity and Health. *Psychosomatic Medicine* 53 (4), pp.345-362.

Kiecolt-Glaser, J. K. *et al.* (1992). Acute Psychological Stressors and Short-Term Immune Changes: What, Why, for Whom, and to What Extent? *Psychosomatic Medicine* 54 (6), pp.680-685.

Kiecolt-Glaser, J. K. *et al.* (1993). Negative Behavior During Marital Conflict is Associated with Immunological Down-regulation. *Psychosomatic Medicine* 55 (5), pp.395-412.

Kiecolt-Glaser, J. K. *et al.* (1995). Slowing of Wound Healing by Psychological Stress. *The Lancet* 346 (8984), pp.1194-1196.

Kiecolt-Glaser, J. K. *et al.* (1996a). Chronic Stress Alters the Immune Response to Influenza Virus Vaccine in Older Adults. *PNAS* 93 (7), pp.3043-3047.

Kiecolt-Glaser, J. K. *et al.* (1996b). Marital Conflict and Endocrine Function: Are Men Really More Physiologically Affected than Women? *Journal of Consulting and Clinical Psychology* 64 (2), pp.324-332.

Kiecolt-Glaser, J. K. *et al.* (1997). Marital Conflict in Older Adults: Endocrinological and Immunological Correlates. *Psychosomatic Medicine* 59 (4), pp.339-349.

Kiecolt-Glaser, J. K. *et al.* (1988). Marital Discord and Immunity in Males. *Psychosomatic Medicine* 50 (3), pp.213-229.

Kiecolt-Glaser, J. K. *et al.* (2002a). Psychoneuroimmunology and Psychosomatic Medicine: Back to the Future. *Psychosomatic Medicine* 64 (1), pp.15-28.

Kiecolt-Glaser, J. K. *et al.* (2002b). Psychoneuroimmunology: Psychological Influences on Immune Function and Health. *Journal of Consulting and Clinical Psychology* 70 (3), pp.537-547.

Kiecolt-Glaser, J. K. *et al.* (2002c). Psycho-Oncology and Cancer: Psychoneuroimmunology and Cancer. *Annals of Oncology* 13 (SUPPL. 4), pp.165-169.

Kiecolt-Glaser, J. K. *et al.* (2003a). Love, Marriage, and Divorce: Newlyweds' Stress Hormones Foreshadow Relationship Changes. *Journal of Consulting and Clinical Psychology* 71 (1), pp.176-188.

Kiecolt-Glaser, J. K. *et al.* (2003b). Chronic Stress and Age-related Increases in the Proinflammatory Cytokine IL-6. *PNAS* 100 (15), pp.9090-9095.

Kiecolt-Glaser, J. K. *et al.* (2005). Hostile Marital Interactions, Proinflammatory Cytokine Production, and Wound Healing. *Archives of General Psychiatry* 62 (12), pp.1377-1384.

Kilby, K. (2000). Perichoresis and Projection: Problems with Social Doctrines of the Trinity. *New Blackfriars* 81, pp.432-445.

Kilby, K. (2012). *Balthasar: A (very) Critical Introduction.* Grand Rapids: Eerdmans.

Kim, J. (1989). Mechanism, Purpose, and Explanatory Exclusion. *Philosophical Perspectives* 3, pp.77-108.

Kim, J. (1991). Epiphenomenal and Supervenient Causation. In: Rosenthal, D. M. (ed.) *The Nature of Mind*. Oxford: OUP, pp.257-265.

Kim, J. (1993). The Non-Reductivist's Trouble with Mental Causation. In: Heil, J. and Mele, A. (eds.) *Mental Causation*. New York: OUP, pp.189-210.

Kim, J. (1998). *Mind in a Physical World. .* Cambridge, MA: MIT Press.

Kim, J. (1999). Making Sense of Emergence. *Philosophical Studies* 95 (1), pp.3-36.

Kim, J. (2005). *Physicalism or Something Near Enough.* Princeton: Princeton University Press.

Kim, J. (2006). Emergence: Core ideas and issues. *Synthese* 151 (3), pp.547-559.

Kim, Y.-K. *et al.* (2008). Differences in Cytokines Between Non-suicidal Patients and Suicidal Patients in Major Depression. *Progress in Neuro-Psychopharmacology and Biological Psychiatry* 32 (2), pp.356-361.

Kimmel, P. L. *et al.* (2000). Dyadic Relationship Conflict, Gender, and Mortality in Urban Hemodialysis Patients. *Journal of the American Society of Nephrology* 11 (8), pp.1518-1525.

Klein, C. (2012). Cognitive Ontology and Region- versus Network-oriented Analyses. *Philosophy of Science* 79 (5), pp.952-960.

Kleinke, C. L. (1986). Gaze and Eye Contact: a Research Review. *Psychological Bulletin* 100 (1), pp.78-100.

Knight, C. C. (2001). *Wrestling with the Divine: Religion, Science and Revelation.* Theology and the Sciences. Minneapolis: Fortress Press.

Koenig, H. G. and Cohen, H. J. (eds.) (2002). *The Link between Religion and Health: Psychoneuroimmunology and the Faith Factor.* Oxford: Oxford University Press.

Koenig, H. G., McCullough, M. and Larson, D. (2001). *The Handbook of Religion and Health.* Oxford: Oxford University Press.

Koertge, N. (ed.) (2000). *A House Built on Sand: Exposing Postmodernist Myths About Science* New York: OUP Inc.

Korte, S. M. *et al.* (2005). The Darwinian Concept of Stress: Benefits of Allostasis and Costs of Allostatic Load and the Trade-offs in Health and Disease. *Neuroscience and Biobehavioral Reviews* 29 (1), pp.3-38.

Koshino, H. *et al.* (2008). fMRI Investigation of Working Memory for Faces in Autism: Visual Coding and Underconnectivity with Frontal Areas. *Cerbral Cortex* 18 (2), pp.289-300.

Koski, L. *et al.* (2002). Modulation of Motor and Premotor Activity during Imitation of Target-directed Actions. *Cerebral Cortex* 12 (8), pp.847-855.

Kourtzi, Z. and Kanwisher, N. (2000). Activation in Human MT/MST by Static Images with Implied Motion. *Journal of Cognitive Neuroscience* 12, pp.48-55.

Kouvonen, A. *et al.* (2011). Negative Aspects of Close Relationships as Predictor of Increase in Body Mass Index and Waist Circumference: the Whitehall II Study. *American Journal of Public Health* 101 (8), pp.1474-1480.

Krakowski, A. I. *et al.* (2011). The Neurophysiology of Human Biological Motion Processing: A High-Density Electrical Mapping Study. *NeuroImage* 56 (1), pp.373-383.

Kulik, J. A. and Mahler, H. I. M. (2006). Marital Quality Predicts Hospital Stay Following Coronary Artery Bypass Surgery for Women but not Men. *Social Science and Medicine* 63 (8), pp.2031-2040.

LaBar, K. S. *et al.* (2003). Dynamic Perception of Facial Affect and Identity in the Human Brain. *Cerebral Cortex* 13 (10), pp.1023-1033.

LaCugna, C. M. (1991). *God for Us: The Trinity and Christian Life.* San Francisco: HarperSanFrancisco.

Ladd, G. E. and Hagner, D. A. (1996). *A Theology of the New Testament.* Rev Ed. Grand Rapids, Michigan: Wm. B Eerdmans.

Laenen, J. H. (2001). *Jewish Mysticism: an Introduction.* Louisville: Westminster John Knox Press.

Lakey, B. and Orehek, E. (2011). Relational Regulation Theory: A New Approach to Explain the Link between Perceived Social Support and Mental Health. *Psychological Review* 118 (3), pp.482-495.

Laudan, L. (1977). *Progress and its Problems: Towards a Theory of Scientific Growth.* Berkeley: University of California Press.

Laudan, L. (1990). *Science and Relativism: Some Key Controversies in the Philosophy of Science.* Chicago/London: University of Chicago Press.

Laudan, L. (1996). *Beyond Positivism and Relativism: Theory, Method and Evidence.* Boulder Colorado: Westview.

Law, D., R (2010). Kenotic Christology. In: Fergusson, D. A. (ed.) *The Blackwell Companion to Nineteenth-Century Theology*. Chichester: John Wiley & Sons, pp.251-279.

Lawrence, R. J. and Després, C. (2004). Futures of Transdisciplinarity. *Futures* 36 (4), pp.397-405.

Leserman, J. *et al.* (2000). Impact of Stressful Life Events, Depression, Social Support, Coping, and Cortisol on Progression to AIDS. *American Journal of Psychiatry* 157 (8), pp.1221-1228.

Leserman, J. *et al.* (2002). Progression to AIDS, a Clinical AIDS Condition and Mortality: Psychosocial and Physiological Predictors. *Psychological Medicine* 32 (6), pp.1059-1073.

Levenson, R. W., Ekman, P. and Friesen, W. V. (1990). Voluntary Facial Action Generates Emotion Specific Autonomic Nervous System Activity. *Psychophysiology* 27 (4), pp.363-384.

Levy, S. M. *et al.* (1990). Perceived Social Support and Tumor Estrogen/Progesterone Receptor Status as Predictors of Natural Killer Cell Activity in Breast Cancer Patients. . *Psychosomatic Medicine* 52, pp.73-85.

Lewes, G. H. (1879). *Problems of Life and Mind.* London: Truebner.

Lewis, M. D. (2005). Bridging Emotion Theory and Neurobiology Through Dynamic Systems Modelling. *Behavioural and Brain Sciences* 28, pp.169-194.

Li, X. *et al.* (2009). Elevated Immune Response in the Brain of Autistic Patients. *Journal of Neuroimmunology* 207 (1-2), pp.111-116.

Libby, P. and Theroux, P. (2005). Pathophysiology of Coronary Artery Disease. *Circulation* 111 (25), pp.3481-3488.

Lieberman, M. D. (2007). Social Cognitive Neuroscience: A Review of Core Processes. *Annual Review of Psychology* 58 (1), pp.259-289.

Lieberman, M. D., Berkman, E. T. and Wager, T. D. (2009). Correlations in Social Neuroscience Aren't Voodoo: Commentary on Vul et al. (2009). *Perspectives on Psychological Science* 4 (3), pp.299-307.

Lieberman, M. D., Jarcho, J. M. and Obayashi, J. (2005). Attributional Inference Across Cultures: Similar Automatic Attributions and Different Controlled Corrections. *Personality and Social Psychology Bulletin* 31 (7), pp.889-901.

Light, K. C., Grewen, K. M. and Amico, J. A. (2005). More Frequent Partner Hugs and Higher Oxytocin Levels are Linked to Lower Blood Pressure and Heart Rate in Premenopausal Women. *Biological Psychology* 69 (1), pp.5-21.

Lindbeck, G. A. (1984). *The Nature of Doctrine.* Philadelphia: Westminster.

Linn, B. S., Linn, M. W. and Klimas, N. G. (1988). Effects of psychophysical stress on surgical outcome. *Psychosomatic Medicine* 50 (230-44).

Livingstone, D. N. (2003). *Putting Science in its Place: Geographies of Scientific Knowledge.* Chicago: University of Chicago Press.

Lockery, S. and Sejnowski, T. (1993). Realistic Network Models of Distributed Processing in the Leech. In: Gardner, D. (ed.) *The Neurobiology of neural networks*. Cambridge MA: MIT Press, pp.107-136.

Logothetis, N. K. (2008). What we Can Do and What We Cannot Do with fMRI. *Nature* 453 (7197), pp.869-878.

Logothetis, N. K. and Wandell, B. A. (2004). Interpreting the BOLD Signal. *Annual Review of Physiology* 66 (1), pp.735-769.

Lotze, M. *et al.* (2006). Differential Cerebral Activation During Observation of Expressive Gestures and Motor Acts. *Neuropsychologia* 44 (10), pp.1787-1795.

Loucks, E. B. *et al.* (2006a). Relation of Social Integration to Inflammatory Marker Concentrations in Men and Women 70 to 79 Years. *The American journal of cardiology* 97 (7), pp.1010-1016.

Loucks, E. B. *et al.* (2006b). Social Networks and Inflammatory Markers in the Framingham Heart Study. *Journal of Biosocial Science* 38 (06), pp.835-842.

Loving, T. J. *et al.* (2004). Stress Hormone Changes and Marital Conflict: Spouses' Relative Power Makes a Difference. *Journal of Marriage & Family* 66 (3), pp.595-612.

Lowe, W. J. (1986). *Introduction in 'Fallible Man' by Paul Ricoeur.* New York: Fordham University Press.

Lundqvist, L., O (1995). Facial EMG Reactions to Facial Expressions: A Case of Facial Emotional Contagion? *Scandinavian Journal of Psychology* 36 (2), pp.130-141.

Lutgendorf, S. K. *et al.* (2000). Interleukin-6 and Social Support in Gynecologic Cancer Patients. *International Journal of Behavioural Medicine* 7, pp.127-142.

Lutgendorf, S. K. *et al.* (2002). Vascular Endothelial Growth Factor and Social Support in Patients with Ovarian Carcinoma. *Cancer* 95 (4), pp.808-815.

Lutgendorf, S. K. *et al.* (2005). Social Support, Psychological Distress, and Natural Killer Cell Activity in Ovarian Cancer. *Journal of Clinical Oncology* 23 (28), pp.7105-7113.

Macchi, V. C., Turati, C. and Simion, F. (2004). Can a Nonspecific Bias Toward Top-Heavy Patterns Explain Newborns' Face Preference? *Psychological Science* 15 (6), pp.379-383.

MacDonald, P. S. (2001). Gabriel Marcel. In: MacDonald, P. S. (ed.) *The Existentialist Reader: An Anthology of key texts*. New York: Routledge, pp.79-85.
MacKay, D. G. (1998). Stage Theories Refuted. In: Bechtel, W. and Graham, G. (eds.) *A Companion to Cognitive Science*. Oxford: Basil Blackwell, pp.71-78.
Maclean, P., D (1990). *The Triune Brain in Evolution.* NewYork: Plenum.
Macmurray, J. (1961). *Persons in Relation.* London: Faber and Faber.
Macrae, C. N. *et al.* (2002). Are You Looking at Me? Eye Gaze and Person Perception. *Psychological Science* 13 (5), pp.460-464.
Malarkey, W. B. *et al.* (1994). Hostile Behavior During Marital Conflict Alters Pituitary and Adrenal Hormones. *Psychosomatic Medicine* 56 (1), pp.41-51.
Manera, V. *et al.* (2010). Inferring Intentions from Biological Motion: A Stimulus Set of Point-Light Communicative Interactions. *Behavior Research Methods* 42 (1), pp.168-178.
Marcel, G. (1927/1952). *Metaphysical Journal.* Chicago: Henry Regnery Company.
Marcel, G. (1930/2001). On the Ontological Mystery. In: MacDonald, P. S. (ed.) *The Existentialist Reader: An Anthology of key texts*. New York: Routledge, pp.86-107.
Marcel, G. (1948). *The Philosophy of Existence.* London: Harvill Press.
Marcel, G. (1948/2002). *Creative Fidelity.* ET ed. New York: Fordham University Press.
Marcel, G. (1949). *Being and Having.* Westminster: Dacre Press.
Marcel, G. (1951a). *Homo Viator.* London: Victor Gollancz Ltd.
Marcel, G. (1951b). *The Mystery of Being: Reflection and Mystery.* ET Ed. London: The Harvill Press.
Marcel, G. (1952). *Man Against Mass Society.* Chicago: Henry Regnery.
Marcel, G. (1960a). *The Mystery of Being, vol.1: Reflection and Mystery.* ET Ed. Chicago: Regnery.
Marcel, G. (1960b). *The Mystery of Being, vol. 2: Faith and Reality.* ET Ed. Chicago: Regnery.
Marcel, G. (1963). *The Existential Background of Human Dignity. .* Cambridge. Mass.: Harvard University Press.
Marcel, G. (1967a). *Man Against Mass Society.* Chicago: Henry Regnery.
Marcel, G. (1967b). *Presence and Immortality.* Pittsburgh: Duquesne University Press.
Marcel, G. (1973). *Tragic Wisdom and Beyond.* Evanston: Northwestern University Press.
Marcel, G. (1995). *The Philosophy of Existentialism.* ET Ed. New York: Carol Publishing Group.
Marcel, G. (1998). Concrete Approaches to Investigating the Ontological Mystery. In: Hanley, K. R. (ed.) *Gabriel Marcel's Perspectives on The Broken World*. Milwaukee: Marquette University Press, pp.172-197.
Marcel, G. and Hanley, K. R. (2004). *Ghostly Mysteries.* ET Ed. Milwaukee: Marquette University Press.
Marcenes, W. and Sheiham, A. (1996). The Relationship between Marital Quality and Oral Health Status. *Psychology and Health* 11 (3), pp.357-369.
Marcum, J. A. (2003). Mechanized Bodies or Embodied Persons? Alternative Models of the Patient's Body in Modern Medicine. In: Twohig, P. and Kalitzkus, V. (eds.) *Interdisciplinary Perspectives on Health, Illness and Disease*. Amsterdam: Rodopi, pp.35-52.

Martin, R. P. (1998). Carmen Christi Revisited. In: Martin, R., P and Dodd, B. J. (eds.) *Where Christology Began: Essays on Philippians 2*. Louisville: John Knox Press, pp.1-5.

Masten, C. L. *et al.* (2012). Time Spent with Friends in Adolescence Relates to Less Neural Sensitivity to Later Peer Rejection. 7 (1), pp.106-114.

Matheson, C. (2009). *Historicist Theories of Rationality.* In: Zalta, E. N., ed. *The Stanford Encyclopedia of Philosophy (Spring 2009 Edition).* plato.standford.edu.

Mayne, T. J. *et al.* (1997). The Differential Effects of Acute Marital Distress on Emotional, Physiological and Immune Functions in Maritally Distressed Men and Women. *Psychology and Health* 12 (2), pp.277-288.

Mays, J. L. (2006). The Self in the Psalms and the Image of God. In: Miller, P. D., Tucker, Gene M. (ed.) *Preaching and Teaching the Psalms*. Louisville, Kentucky: Westminster John Knox, pp.51-68.

McEwen, B. S. and Wingfield, J. C. (2003). The Concept of Allostasis in Biology and Biomedicine. *Hormones and Behavior* 43 (1), pp.2-15.

McGrath, A. E. (2010). *Science and Religion: A New Introduction.* 2nd Ed. Chichester: Wiley-Blackwell.

McGuire, L. and Kiecolt-Glaser, J. K. (2000). Interpersonal Pathways to Health. *Psychiatry: Interpersonal & Biological Processes* 63 (2), p.136.

McIntosh, M. (2007). von Balthasar. In: Jones, G. and Arrandale, R. (eds.) *The Blackwell Companion to Modern Theology*. Oxford: John Wiley & Sons, pp.388-402.

McMullin, E. (1981). How Should Cosmology Relate to Theology? In: Peacocke, A. R. (ed.) *The Sciences and Theology in the Twentieth Century*. Notre Dame: University of Notre Dame Press, pp.17-57.

Meltzoff, A. N. (2002). Elements of a Developmental Theory of Imitation. In: Meltzoff, A. N. and Prinz, W. (eds.) *The Imitative Mond: Development, Evaluation and Brain Bases*. Cambridge: CUP.

Meltzoff, A. N. and Decety, J. (2003). What Imitation Tells Us about Social Cognition: A Rapprochement between Developmental Psychology and Cognitive Neuroscience. *Philosophical Transactions: Biological Sciences* 358 (1431), pp.491-500.

Merzenich, M., Allard, T. and Jenkins, W. (1990). Neural Ontogeny of Higher Brain Function: Implications of Some Recent Neurophysiological Findings. In: Franzén, O. and Westman, P. (eds.) *Information Processing in the Somatosensory System*. London: MacMillan, pp.293-311.

Metzinger, T. and Gallese, V. (2003). The Emergence of a Shared Action Ontology: Building Blocks for a Theory. *Consciousness and Cognition* 12 (4), pp.549-571.

Michaud, T. A. (1995). Gabriel Marcel and the Postmodern World. *Bulletin de la Société Américaine de Philosophie de Langue Française* VII (1-2), pp.5-29.

Midgley, M. (2000). Consciousness, Fatalism and Science. In: Gregersen, N. H., Drees, W. B. and Görman, U. (eds.) *The Human Person in Science and Theology*. Edinburgh: T&T Clark, pp.21-40.

Midgley, M. (2006). *Science and Poetry.* Abingdon: Routledge Classics.

Miller, A. H., Maletic, V. and Raison, C. L. (2009). Inflammation and Its Discontents: The Role of Cytokines in the Pathophysiology of Major Depression. *Biological Psychiatry* 65 (9), pp.732-741.

Miller, G. E., Cohen, S. and Ritchey, A. K. (2002). Chronic Psychological Stress and the Regulation of Pro-inflammatory Cytokines: a Glucocorticoid-resistance Model. *Health Psychology* 21, pp.531-541.

Miller, G. E. *et al.* (1999). Psychosocial Predictors of Natural Killer Cell Mobilization During Marital Conflict. *Health Psychology* 18 (3), pp.262-271.

Miller, K. R. (1999). *Finding Darwin's God: A Scientist's Search for Common Ground Between God and Evolution.* New York: Harper Collins.

Mills, P. J. *et al.* (2000). Leukocyte Adhesion Molecule Expression and T Cell Naive/Memory Status following Isoproterenol Infusion. *Journal of Neuroimmunology* 102 (2), p.137.

Mintzes, B. (2002). For and Against: Direct to Consumer Advertising is Medicalising Normal Human Experience: For. *BMJ* 324 (7342), pp.908-909.

Miyazaki, T. *et al.* (2005). Association between Perceived Social Support and Th1 Dominance. *Biological Psychology* 70 (1), pp.30-37.

Moltmann, J. (2001). God's Kenosis in the Creation and Consummation of the World. In: Polkinghorne, J. (ed.) *The Work of Love: Creation as Kenosis*. Grand Rapids/Cambridge: Eerdmans/SPCK, pp.137-151.

Monti, M. M. (2011). *Statistical Analysis of fMRI Time-Series: A Critical Review of the GLM Approach.Frontiers in Human Neuroscience.*

Montuori, A. (2008). Foreword. *On Complexity*. ET Ed. Cresskill, NJ: Hampton Press, pp.vii-xliv.

Morell, M. A. and Apple, R. F. (1990). Affect Expression, Marital Satisfaction, and Stress Reactivity Among Premenopausal Women During A Conflictual Marital Discussion. *Psychology of Women Quarterly* 14 (3), pp.387-402.

Morgan, C. L. (1927). *Emergent Evolution.* 2nd ed. London: Williams & Norgate.

Morin, E. (1992). From the Concept of System to the Paradigm of Complexity. *Journal of Social and Evolutionary Systems* 15 (4), pp.371-385.

Morin, E. (2008). *On Complexity.* Advances in Systems Theory, Complexity and the Human Sciences. Cresskill, NJ: Hampton Press Inc.

Morris, D. B. (1998). *Illness and Culture in the Postmodern Age.* Berkley and Los Angeles, California, London, England: University of California Press.

Morris, P. L. *et al.* (1993). Association of Depression with 10-year Poststroke Mortality. *The American Journal of Psychiatry* 150 (1), pp.124-129.

Moynihan, J. A. *et al.* (2004). Psychosocial Factors and the Response to Influenza Vaccination in Older Adults. *Psychosomatic Medicine* 66 (6), pp.950-953.

Moynihan, R. and Smith, R. (2002). Too Much Medicine? *BMJ* 324 (7342), pp.859-860.

Murphy, F. (1995). *Christ the Form of Beauty: A Study in Theology and Literature.* Edinburgh: T&T Clark.

Murphy, N. and Stoeger, W. R. (eds.) (2007). *Evolution and Emergence.* Oxford: OUP.

Murphy, N. C. (1985). A Niebuhrian Typology for the Relation of Theology to Science. *Pacific Theological Review* XVIII (3), pp.16-23.

Murray, P. D. (2011). Truth and Reason in Science and Theology: Points of Tension, Correlation and Compatibility. In: Southgate, C. (ed.) *God, Humanity and the Cosmos*. 3rd ed. London/New York: T&T Clark, pp.89-124.

Naidoo, J. and Wills, J. (eds.) (2008). *Health Studies: An introduction.* 2nd Ed. Basingstoke/New York Palgrave Macmillan.

Nealey-Moore, J. B. *et al.* (2007). Cardiovascular Reactivity During Positive and Negative Marital Interactions. *Journal of Behavioral Medicine* 30 (6), pp.505-519.

Nelson, C. A. (2001). The Development and Neural Bases of Face Recognition. *Infant & Child Development* 10 (1/2), pp.3-18.
Newberg, A. B. (2005). *Neuroscience and Religion: Neurotheology.* In: Jones, L., ed. *Encyclopedia of Religion.* Detroit: Macmillan Reference USA.
Newberg, A. B. (2010). *Principles of Neurotheology.* Ashgate Science and Religion Series. Farnham: Ashgate.
Newberg, A. B. and Lee, B. Y. (2005). The Neuroscientific Study of Religious and Spiritual Phenomena: Or Why God Doesn't Use Biostatistics. *Zygon* 40 (2), pp.469-489.
Newman, D. V. (1996). Emergence and Strange Attractors. *Philosophy of Science* 63 (2), pp.245-261.
Nicholls, A. (2000). *No Bloodless Myth: A Guide Through Balthasar's Dramatics.* Washington DC: The Catholic University of America Press.
Nichols, T. E. and Poline, J.-B. (2009). Commentary on Vul et al.'s (2009) 'Puzzlingly High Correlations in fMRI Studies of Emotion, Personality, and Social Cognition'. *Perspectives on Psychological Science* 4 (3), pp.291-293.
Nicolescu, B. (2002). A New Vision of the World — Transdisciplinarity. In: *The design and delivery of inter- and pluri-disciplinary research: Proceedings from MUSCIPOLI Workshop Two*: The Danish Institute for Studies in Research and Research Policy.
Nicolescu, B. (2005). Transdisciplinarity – Past, Present and Future. In: *Moving worldviews: Reshaping sciences, policies and practices for Endogenous Sustainable Development*. Soesterberg, The Netherlands: ETC/Compas, Leusden
Nicolescu, B. (2008). In Vitro and In Vivo Knowledge - Methodology of Transdisciplinarity. In: Montuori, A. (ed.) *Transdisciplinarity: Theory and Practice*. Cresskill, NJ: Hampton Press, Inc.
Niebuhr, R. (1943/1996). *The Nature and Destiny of Man: A Christian Interpretation. .* Louisville: Westminster John Knox.
Niebuhr, R. (1963). *Moral Man and Immoral Society.* London: SCM.
Norenzayan, A. and Nisbett, R. E. (2000). Culture and Causal Cognition. *Current Directions in Psychological Science* 9 (4), pp.132-135.
Noriega, G. (2008). Modelling Propagation Delays in the Development of SOMs -- a Parallel with Abnormal Brain Growth in Autism. *Neural Networks* 21 (2-3), pp.130-139.
Numbers, R. (2006). *The Creationists: From Scientific Creationism to Intelligent Design.* Cambridge, MA: Harvard University Press.
Numbers, R. L. (ed.) (2009). *Gallileo Goes to Jail and Other Myths About Science and Religion.* Cambridge MA: Harvard University Press.
Olsen, O. (1993). Impact of Social Network on Cardiovascular Mortality in Middle aged Danish Men. *Journal of Epidemiology & Community Health* 47 (3), pp.176-180.
Orth-Gomér, K. and Johnson, J. V. (1987). Social Network Interaction and Mortality: A Six Year Follow-up Study of a Random Sample of the Swedish Population. *Journal of Chronic Diseases* 40 (10), pp.949-957.
Orth-Gomér, K., Undén, A.-L. and Edwards, M.-E. (1988). Social Isolation and Mortality in Ischemic Heart Disease. *Acta Medica Scandinavica* 224 (3), pp.205-215.
Orth-Gomér, K. *et al.* (2000). Marital Stress Worsens Prognosis in Women with Coronary Heart Disease. *JAMA* 284 (23), pp.3008-3014.

Osmer, R. R. (2005). *The Teaching Ministry of Congregations.* Louisville: Westminster John Knox Press.

Osmer, R. R. (2006). Toward a Transversal Model of Interdisciplinary Thinking in Practical Theology *The Evolution of Rationality*. Grand Rapids, : Eerdmans, pp.327-345.

Pamplume, L. and Brombert, B. (1953). Gabriel Marcel: Existence, Being, and Faith. *Yale French Studies* (12), pp.88-100.

Pannenberg, W. (1977). *Jesus God and Man.* Philadelphia: The Westminster Press.

Papanikolaou, A. (2004). Is John Zizioulas an Existentialist in Disguise? Response to Lucian Turcescu. *Modern Theology* 20 (4), pp.601-607.

Parker, D. (2006). Complexities and Uncertainties of Neuronal Network Function. *Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences* 361 (1465), pp.81-99.

Patterson, T. *et al.* (1996). Relationship of Psychosocial Factors to HIV Disease Progression. *Annals of Behavioral Medicine* 18 (1), pp.30-39.

Peacocke, A. (1993). *Theology for a Scientific Age.* Enlarged ed. Minneapolis: Fortress.

Peacocke, A. (2001). The Cost of New Life. In: Polkinghorne, J. (ed.) *The Work of Love. Creation as Kenosis*. Grand Rapids/London: Eerdmans/SPCK, pp.21-42.

Pelphrey, K. A. *et al.* (2003). Brain Activity Evoked by the Perception of Human Walking: Controlling for Meaningful Coherent Motion. *The Journal of Neuroscience* 23 (17), pp.6819-6825.

Penninx, B. W. J. H. *et al.* (1997). Effects of Social Support and Personal Coping Resources on Mortality in Older Age: The Longitudinal Aging Study Amsterdam. *American Journal of Epidemiology* 146 (6), pp.510-519.

Perry, S. *et al.* (1992). Relationships Over 1 Year Between Lymphocyte Subsets and Psychosocial Variables Among Adults with Infection by Human Immunodeficiency Virus. *Archives of General Psychiatry* 49, pp.396-401.

Persson, L. *et al.* (2002). Social Network, Social Support and the Rate of Decline of CD4 Lymphocytes in Asymptomatic HIV-positive Homosexual Men. *Scandinavian Journal of Public Health* 30 (3), pp.184-190.

Persson, L. *et al.* (1994). HIV Infection: Social Network, Social Support, and CD4 Lymphocyte Values in Infected Homosexual Men in Malmő, Sweden. *Journal of Epidemiology & Community Health* 48 (6), pp.580-585.

Peters, T. (1993). *God as Trinity: Relationality and Temporality in the Divine Life.* Louisville: Westminster John Knox.

Peters, T. (1997). Theology and Natural Science. In: Ford, D. F. (ed.) *The Modern Theologians*. 2nd ed. Oxford: Blackwell, pp.649-668.

Peterson, G. R. (2008). Uniqueness, the Image of God, and the Problem of Method: Engaging van Huyssteen. *Zygon: Journal of Religion & Science* 43 (2), pp.467-474.

Phillips, A. C. *et al.* (2006). Bereavement and Marriage are Associated with Antibody Response to Influenza Vaccination in the Elderly. *Brain, Behavior, and Immunity* 20 (3), pp.279-289.

Phillips, M. L. *et al.* (1997). A Specific Neural Substrate for Perceiving Facial Expressions pf Disgust. *Nature* 389 (6650), pp.495-498.

Piaget, J. (1973). *Main Trends in Interdisciplinary Research.* London: George Allen & Unwin.

Pinquart, M. and Duberstein, P. R. (2010). Associations of Social Networks with Cancer Mortality: A Meta-analysis. *Critical Reviews in Oncology/Hematology* 75 (2), pp.122-137.

Polanyi, M. (1962). *Personal Knowledge: Towards a Post-Critical Philosophy.* Corrected ed. London: Routledge & Kegan Paul.

Poldrack, R. A. (2006). Can Cognitive Processes be Inferred from Neuroimaging Data? *Trends in Cognitive Sciences* 10 (2), pp.59-63.

Polkinghorne, J. (1991). *Reason and Reality.* London: SPCK.

Polkinghorne, J. (1996). *Scientists as Theologians: A Comparison of the Writings of Ian Barbour, Arthur Peacocke and John Polkinghorne.* London: SPCK.

Polkinghorne, J. (1998). *Belief in God in an Age of Science.* New Haven/London: Yale University Press.

Polkinghorne, J. (1999). Wolfhart Pannenberg's Engagement With the Natural Sciences. *Zygon* 34 (1), pp.151-158.

Polkinghorne, J. (2001). Kenotic Creation and Divine Action. In: Polkinghorne, J. (ed.) *The Work of Love: Creation as Kenosis*. Grand Rapids/London: Eerdmans/SPCK, pp.90-106.

Polkinghorne, J. (2004). *Science and the Trinity: The Christian Encounter with Reality.* London: SPCK.

Polkinghorne, J. (2006). Where is Natural Theology Today? *Science and Christian Belief* 18 (2), pp.169-179.

Polkinghorne, J. (2007). *Quantum Physics and Theology: An Unexpected Kinship.* London: SPCK.

Polkinghorne, J. (2008). *Theology in the Context of Science.* London: SPCK.

Pollick, F. E., Kay, J. W., Heim, K., & Stringer, R. (2005). Gender Recognition from Point-light Walkers. *Journal of Experimental Psychology: Human Perception and Performance* 31 (6), pp.1247–1265.

Popper, K. (1969). *Conjectures and Refutations.* London: Routledge and Kegan Paul.

Popper, K. (1979). *Objective Knowledge: An Evolutionary Approach.* Rev Ed. Oxford: OUP.

Porter, R. (1999). *The Greatest Benefit to Mankind: A Medical History of Humanity from Antiquity to the Present.* Paperback Ed. Hammersmith, London: HarperCollins Publishers.

Pressman, S. D. *et al.* (2005). Loneliness, Social Network Size, and Immune Response to Influenza Vaccination in College Freshmen. *Health Psychology* 24 (3), pp.297-306.

Prigogine, I. (1997). *The End of Certainty: Time, Chaos and the New Laws of Nature.* Trans ed. New York: Free Press.

Prigogine, I. and Stengers, I. (1984). *Out of Chaos: Man's New Dialogue with Nature.* New York: Bantam.

Prokopenko, M., Boschetti, F. and Ryan, A. J. (2009). An Information-Theoretic Primer on Complexity, Self-Organization, and Emergence. *Complexity* 15 (1), pp.11-28.

Puce, A. *et al.* (1996). Differential Sensitivity of Human Visual Cortex to Faces, Letterstrings, and Textures: A Functional Magnetic Resonance Imaging Study. *The Journal of Neuroscience* 16 (16), pp.5205-5215.

Puce, A. *et al.* (1995). Face-Sensitive Regions in Human Extrastriate Cortex Studied by Functional MRI. *Journal of Neurophysiology* 74 (3), pp.1192-1199.

Puce, A. and Perrett, D. (2003). Electrophysiology and Brain Imaging of Biological Motion. *Philosophical Transactions: Biological Sciences* 358 (1431), pp.435-445.

Quash, B. (2004). The Theo-drama. In: Oakes, E. T. and Moss, D. (eds.) *The Cambridge Companion to Hans Urs von Balthasar*. Cambridge: CUP, pp.143-157.

Radley, A. (1994). *Making sense of illness.* Paperback Ed. London: Sage Publications Ltd.

Ramnani, N. and Miall, R. C. (2004). A System in the Human Brain for Predicting the Actions of Others. *Nature Neuroscience* 7 (1), pp.85-90.

Ramsey, P. (1950). *Basic Christian Ethics.* New York: Charles Scribner's Sons.

Ratnasingam, P. and Bishop, G. D. (2007). Social Support Schemas, Trait Anger, and Cardiovascular Responses. *International Journal of Psychophysiology* 63 (3), pp.308-316.

Ravitzky, A. (2009). "Peace". In: Cohen, A. A. and Mendes-Flohr, P. (eds.) *Contemporary Jewish Religious Thought: Essays on Critical Concepts, Movements and Beliefs*. Philadelphia: The Jewish Publication Society, pp.685-702.

Reich, K. H. (2002). *Developing the Horizons of the Mind: Relational and Contextual Reasoning and the Resolution of Cognitive Conflict.* Cambridge: CUP.

Reinhardt, J. P., Boerner, K. and Horowitz, A. (2006). Good to Have but Not to Use: Differential Impact of Perceived and Received Support on Well-being. *Journal of Social and Personal Relationships* 23 (1), pp.117-129.

Rescher, N. (1990). *A Useful Inheritance: Evolutionary Aspects of the Theory of Knowledge,.* Studies in Epistemology and Cognitive Theory. Savage, Maryland: Rowman & Littlefield.

Rescher, N. (1992). *A System of Pragmatic Idealism Vol 1.* Princeton: Princeton University Press.

Rescher, N. (1995). *Pluralism: Against the Demand for Consensus.* Oxford: Clarendon Press.

Reynolds, P. and Kaplan, G. A. (1990). Social Connections and Risk for Cancer: Prospective Evidence from the Alameda County Study. *Behavioral Medicine* 16, pp.101-110.

Richardson, M. (1994). Research Fellows Report. *CTNS Bulletin* 14 (3).

Riches, J. and Quash, B. (1997). Hans Urs von Balthasar. In: Ford, D. F. (ed.) *The Modern Thologians*. 2nd ed. Oxford: Blackwell Publishing.

Ricoeur, P. (1965). The Image of God and the Epic of Man *History and Truth*. Evanston: Northwestern University Press.

Ricoeur, P. (1967). *The Symbolism of Evil.* ET Ed. Boston: Beacon Press.

Ricoeur, P. (1981). The Hermeneutical Function of Distanciation. In: Thompson, J. B. (ed.) *Hermeneutics and the Human Sciences*. Cambridge: CUP, pp.131-144.

Ricoeur, P. (1986). *Fallible Man.* New York: Fordham University Press.

Ridker, P. M. *et al.* (2004). Established and Emerging Plasma Biomarkers in the Prediction of First Atherothrombotic Events. *Circulation* 109 (25 suppl 1), pp.IV-6-IV-19.

Rigato, S., Farroni, T. and Johnson, M. H. (2010). The Shared Signal Hypothesis and Neural Responses to Expressions and Gaze in Infants and Adults. *Social Cognitive and Affective Neuroscience* 5 (1), pp.88-97.

Rigato, S. *et al.* (2011). Direct Gaze may Modulate Face Recognition in Newborns. *Infant and Child Development* 20 (1), pp.20-34.

Rilling, J. K. *et al.* (2002). A Neural Basis for Social Cooperation. *Neuron* 35 (2), pp.395-405.
Rizzolatti, G. and Craighero, L. (2004). The Mirror-Neuron System. *Annual Review of Neuroscience* 27, pp.169-192.
Rizzolatti, G. and Fabbri-Destro, M. (2010). Mirror Neuron Mechanism. In: Koob, G., Le Moal, M. and Thompson, R. (eds.) *Encyclopedia of Behavioral Neuroscience*. Oxford: Academic Press, pp.240-249.
Rizzolatti, G., Fogassi, L. and Gallese, V. (2001). Neurophysiological Mechanisms Underlying the Understanding and Imitation of Action. *Nature Reviews Neuroscience* 2 (9), pp.661-670.
Rizzolatti, G. and Sinigaglia, C. (2008). *Mirrors in the Brain: How Our Minds Share Actions and Emotions.* ET ed. Oxford: OUP.
Rizzolatti, G. *et al.* (1996). Premotor Cortex and the Recognition of Motor Actions. *Cognitive Brain Research* 3 (2), pp.131-141.
Robinson, F. P., Mathews, H. L. and Witek-Janusek, L. (2002). Issues in the Design and Implementation of Psychoneuroimmunology Research. *Biological Research for Nursing* 3 (4), pp.165-175.
Robles, T. F. and Kane, H. S. (2012). Marriage. In: Segerstrom, S. C. (ed.) *The Oxford Handbook of Psychoneuroimmunology*. Oxford: OUP, pp.197-213.
Robles, T. F. and Kiecolt-Glaser, J. K. (2003). The Physiology of Marriage: Pathways to Health. *Physiology and Behavior* 79 (3), pp.409-416.
Robles, T. F. *et al.* (2006). Positive Behaviors During Marital Conflict: Influences on Stress Hormones. *Journal of Social & Personal Relationships* 23 (2), pp.305-325.
Robles, T. F. *et al.* (In press). Marital Quality and Health: A Meta-analytic Review. *Psychological Bulletin*.
Rohleder, N. *et al.* (2001). Sex Differences in Glucocorticoid Sensitivity of Proinflammatory Cytokine Production after Psychosocial Stress. *Psychosomatic Medicine* 63 (6), pp.966-972.
Rohrbaugh, M. J., Shoham, V. and Coyne, J. C. (2006). Effect of Marital Quality on Eight-year Survival of Patients with Heart Failure. *The American journal of cardiology* 98 (8), pp.1069-1072.
Rolston, H., III (1990). Joining Science and Religion. In: Russell, R. J., Stoeger, W. R. and Coyne SJ (eds.) *John Paul II on Science and Religion: Reflections on the New View from Rome*. Vatican City: Vatican Observatory, pp.83-94.
Roskies, A., L (2010). Neuroimaging and Inferential Distance: The Perils of Pictures. In: Hanson, S. J. and Bunzl, M. (eds.) *Foundational Issues in Human Brain Mapping*. Cambridge MS: MIT Press, pp.195-215.
Rothman, K. J. *et al.* (2008). Causation and Causal Inference. In: Rothman, K. J., Greenland, S. and Lash, T. L. (eds.) *Modern Epidemiology*. 3rd ed. Philadelphia: Lippincott Williams & Wilkins, pp.5-31.
Ruberman, W. *et al.* (1984). Psychosocial Influences on Mortality after Myocardial Infarction. *New England Journal of Medicine* 311 (9), pp.552-559.
Rubinov, M. and Sporns, O. (2010). Complex Network Measures of Brain Connectivity: Uses and Interpretations. *NeuroImage* 52 (3), pp.1059-1069.
Rue, L. (2007). A Guide to Thinking about Emergence. *Zygon* 42 (4), pp.829-835.
Ruse, M. (2001). *Can a Darwinian be a Christian? The Relationship between Science and Religion.* Cambridge: CUP.
Ruse, M. (2007). My Journey in the World of Religion-and-Science. *Zygon:* 42 (3), pp.577-582.

Russell, E. (2003). Reconsidering Relational Anthropology: A Critical Assessment of John Zizioulas's Theological Anthropology. *International Journal of Systematic Theology* 5 (2), pp.168-186.

Sandel, M. J. (2005). *Public philosophy: Essays on Morality in Politics.* Cambridge MS: Harvard University Press.

Sasson, N. J. (2006). The Development of face Processing in Autism. *Journal of Autism and Developmental Disorders, Vol. 36* 36 (3), pp.381-394.

Saunders, D. R., Williamson, D. K. and Troje, N. F. (2010). Gaze Patterns During Perception of Direction and Gender from Biological Motion. *Journal of Vision* 10 (11), pp.1-10.

Saxbe, D. E., Repetti, R. L. and Nishina, A. (2008). Marital Satisfaction, Recovery from Work, and Diurnal Cortisol among Men and Women. *Health Psychology* 27 (1), pp.15-25.

Saxe, R. (2006). Uniquely Human Social Cognition. *Current Opinion in Neurobiology* 16 (2), pp.235-239.

Saxe, R. and Baron-Cohen, S. (2006). Editorial: The Neuroscience of Theory of Mind. *Social Neuroscience* 1 (3/4), pp.1-9.

Saxe, R., Schulz, L. E. and Jiang, Y. V. (2006). Reading Minds Versus Following Rules: Dissociating Theory of Mind and Executive Control in the Brain. *Social Neuroscience* 1 (3/4), pp.284-298.

Saxe, R. *et al.* (2004). A Region of Right Posterior Superior Temporal Sulcus Responds to Observed Intentional Actions. *Neuropsychologia* 42 (11), pp.1435-1446.

Sbarra, D. A., Law, R. W. and Portley, R. M. (2011). Divorce and Death: A Meta-Analysis and Research Agenda for Clinical, Social, and Health Psychology. *Perspectives on Psychological Science* 6 (5), pp.454-474.

Schrag, C. O. (1992). *The Resources of Rationality.* Bloomington: Indiana University Press.

Schrag, C. O. (1994). Transversal Rationality. In: Stapleton, T. J. (ed.) *The Question of Hermeneutics: Essays in Honour of Joseph J Kockelmans*. Dordrecht: Kluwer Academic Publishers, pp.61-78.

Schulz, K. H. and Schulz, H. (1992). Overview of Psychoneuroimmunological Stress and Intervention Studies in Humans with Emphasis on the Uses of Immunological Parameters. *Psycho-Oncology* 1, pp.51-70.

Searle, J. R. (1983). *Intentionality.* Cambridge: CUP.

Seeman, T. E. (1996). Social Ties and Health: the Benefits of Social Integration,. *Annals of Epidemiology* 6 (5), pp.442-451.

Seeman, T. E. *et al.* (1987). Social NetworkTies and Mortality Among the Elderly in the Alameda County Study. *American Journal of Epidemiology* 126 (4), pp.714-723.

Seeman, T. E. *et al.* (1993). Intercommunity Variations in the Association between Social Ties and Mortality in the Elderly: A Comparative Analysis of Three Communities. *Annals of Epidemiology* 3 (4), pp.325-335.

Segerstrom, S. C. and Miller, G. E. (2004). Psychological Stress and the Human Immune System: A Meta-Analytic Study of 30 Years of Inquiry. *Psychological Bulletin* 130 (4), pp.601-630.

Seixas, D. and Lima, D. (2011). Accuracy, Reliability, Validity and Limitations of Functional and Structural Magnetic Resonance Imaging Data. *Cortex* 47 (10), pp.1266-1269.

Selye, H. (1956). What is Stress? *Metabolism* 5 (5), pp.525-530.

Selye, H. (1973). The Evolution of the Stress Concept. *American Scientist* 61 (6), pp.692-699.
Sen, A. (2002). Health: Perception verses Observation. *BMJ* 324, pp.859-860.
Senju, A., Hasegawa, T. and Tojo, Y. (2005). Does Perceived Direct Gaze Boost Detection in Adults and Children with and without Autism? The Stare-in-the-Crowd Effect Revisited. *Visual Cognition* 12 (8), pp.1474 - 1496.
Senju, A. and Johnson, M. H. (2009). The Eye Contact Effect: Mechanisms and Development. *Trends in Cognitive Sciences* 13 (3), pp.127-134.
Sergent, J. *et al.* (1992). Functional and Anatomical Decomposition of Face Processing: Evidence from Prosopagnosia and PET Study of Normal Subjects [and Discussion]. *Philosophical Transactions: Biological Sciences* 335 (1273), pp.55-62.
Shaw, P. *et al.* (2005). Differential Effects of Lesions of the Amygdala and Prefrontal Cortex on Recognizing Facial Expressions of Complex Emotions. *Journal of Cognitive Neuroscience* 17 (9), pp.1410-1419.
Sherrington, C. S. (1951). *Man and His Nature.* 2nd Ed. Cambridge: CUP.
Shi, J. F. *et al.* (2010). Biological Motion Cues Trigger Reflexive Attentional Orienting. *Cognition* 117 (3), pp.348-354.
Shimada, S. and Hiraki, K. (2006). Infant's Brain Responses to Live and Televised Action. *NeuroImage* 32 (2), pp.930-939.
Shults, F. L. (2003). *Reforming Theological Anthropology: After the Philosophical Turn to Relationality.* Grand Rapids Michigan: Eerdmans.
Simion, F. *et al.* (2001). The Origins of Face Perception: Specific Versus Non-Specific Mechanisms. *Infant & Child Development* 10 (1/2), pp.59-65.
Singer, T. (2006). The Neuronal Basis and Ontogeny of Empathy and Mind Reading: Review of Literature and Implications for Future Research. *Neuroscience & Biobehavioral Reviews* 30 (6), pp.855-863.
Singer, T. *et al.* (2004). Empathy for Pain Involves the Affective but not Sensory Components of Pain. *Science* 303 (5661), pp.1157-1162.
Slatcher, R. B. (2010). Marital Functioning and Physical Health: Implications for Social and Personality Psychology. *Social and Personality Psychology Compass* 4 (7), pp.455-469.
Slatcher, R. B. *et al.* (2010). Momentary Work Worries, Marital Disclosure, and Salivary Cortisol Among Parents of Young Children. *Psychosomatic Medicine* 72 (9), pp.887-896.
Slater, A. and Quinn, P. C. (2001). Face Recognition in the Newborn Infant. *Infant & Child Development* 10 (1/2), pp.21-24.
Slavich, G. M. *et al.* (2010). Black Sheep Get the Blues: A Psychobiological Model of Social Rejection and Depression. *Neuroscience and Biobehavioral Reviews* 35 (1), pp.39-45.
Sloan, E., Collado-Hidalgo, A, and Cole, S. (2007). Psychobiology of HIV Infection. In: Ader, R. (ed.) *Psychoneuroimmunology*. 4th ed. Vol. 2. Burlington, MA: Elsevier, pp.1053-1076.
Sloan, R. P. (2005). *Field Analysis on the Literature on Religion, Spirituality and Health.Metanexus Field Analyses.*
Smedes, T., A (2007). Religion and Science: Finding the Right Questions. *Zygon* 42 (3), pp.595 - 598.
Smith, C. U. M. (2010). The Triune Brain in Antiquity: Plato, Aristotle, Erasistratus. *Journal of the History of the Neurosciences* 19 (1), pp.1-14.

Smith, M. P. (1969). Self-Fulfillment in a Bureaucratic Society: A Commentary on the Thought of Gabriel Marcel. *Public Administration Review* 29 (1), pp.25-32.

Smith, S. M. *et al.* (2009). Correspondence of the Brain's Functional Architecture During Activation and Rest. *PNAS* 106 (31), pp.13040-13045.

Smith, T. and Brown, P. (1991). Cynical Hostility, Attempts to Exert Social Control, and Cardiovascular Reactivity in Married Couples. *Journal of Behavioral Medicine* 14 (6), pp.581-592.

Smith, T. W., Ruiz, J. M. and Uchino, B. N. (2004). Mental Activation of Supportive Ties, Hostility, and Cardiovascular Reactivity to Laboratory Stress in Young Men and Women. *Health Psychology* 23 (5), pp.476-485.

Smith, T. W. *et al.* (2007). Hostile Personality Traits and Coronary Artery Calcification in Middle-aged and Older Married Couples: Different Effects for Self-reports Versus Spouse Ratings. *Psychosomatic Medicine* 69 (5), pp.441-448.

Smolin, L. (2008). *The Trouble with Physics.* London: Penguin.

Sokal, A. D. (2010). *Beyond the Hoax: Science, Philosophy and Culture.* Oxford: OUP.

Sokal, A. D. and Bricmont, J. (1998). *Intellectual Impostures.* London: Profile Books.

Somers, A. R. (1979). Marital Status, Health, and Use of Health Services. *JAMA* 241, pp.1818-1822.

Sontag, S. (1978). *Illness as Metaphor - Aids and its Metaphors.* New York: Farrer, Straus & Giroux.

Southgate, C. and Poole, M. (2011). Introduction. In: Southgate, C. (ed.) *God, Humanity and the Cosmos*. London/New York: T&T Clark, pp.3-43.

Southgate, V. *et al.* (2009). Predictive Motor Activation During Action Observation in Human Infants. *Biology Letters* 5 (6), pp.769-772.

Sporns, O. and Zwi, J. (2004). The Small World of the Cerebral Cortex. *Neuroinformatics* 2 (2), pp.145-162.

Sporns, O. *et al.* (2004). Organization, Development and Function of Complex Brain Networks. *Trends in Cognitive Sciences* 8 (9), pp.418-425.

Sprengelmeyer, R. *et al.* (1998). Neural Structures Associated with Recognition of Facial Expressions of Basic Emotions. *Proceedings of the Royal Society of London. Series B: Biological Sciences* 265 (1409), pp.1927-1931.

St Claire, L., Watkins, C. J. and Billinghurst, B. (1996). Differences in Meanings of Health: an Exploratory Study of General Practitioners and their Patients. *Family Practice* 13 (6), pp.511-516.

Stam, C. and Reijneveld, J. (2007). Graph Theoretical Analysis of Complex Networks in the Brain. *Nonlinear Biomedical Physics* 1 (3), pp.1-19.

Stansfeld, S. A. *et al.* (1998a). Psychosocial Work Characteristics and Social Support as Predictors of Health Functioning: the Whitehall II Study. *Psychosomatic Medicine* 60 (3), pp.247-255.

Stansfeld, S. A., Fuhrer, R. and Shipley, M. J. (1998b). Types of Social Support as Predictors of Psychiatric Morbidity in a Cohort of British Civil Servants (Whitehall II Study). *Psychological Medicine* 28 (04), pp.881-892.

Stark, J. L. *et al.* (2001). Social Stress Induces Glucocorticoid Resistance in Macrophages. *American Journal of Physiology - -Regulatory, Integrative and Comparative Physiology* 280 (6), pp.R1799-R1805.

Steiner, G. (2001). *Grammars of Creation.* London: Faber and Faber.

Stenmark, M. (2004). *How to Relate Science and Religion: A Multidimensional Model.* Grand Rapids/Cambridge: Eerdmans.

Steptoe, A. *et al.* (2004). Loneliness and Neuroendocrine, Cardiovascular, and Inflammatory Stress Responses in Middle-aged Men and Women. *Psychoneuroendocrinology* 29 (5), pp.593-611.

Sterling, P. (2004). Principles of Allostasis: Optimal Design, Predictive Regulation, Pathophysiology and Rational Therapeutics. In: J, S. (ed.) *Allostasis, Homeostasis, and the Costs of Physiological Adaptation* Cambridge: CUP, pp.17-64.

Sterling, P. and Eyer, J. (1988). Allostasis: A New Paradigm to Explain Arousal Pathology. In: Fisher, S. and Reason, J. (eds.) *Hanbook of Life Stress, Cognition and Health*. New York: Wiley and Sons, pp.629-649.

Stone, V. E. and Gerrans, P. (2006). What's Domain-specific About Theory of Mind? *Social Neuroscience* 1 (3/4), pp.309-319.

Stoyanova, R. S., Ewbank, M. P. and Calder, A. J. (2010). "You Talkin' to Me?": Self-Relevant Auditory Signals Influence Perception of Gaze Direction. *Psychological Science* 21 (12), pp.1765-1769.

Sugisawa, H., Liang, J. and Liu, X. (1994). Social Networks, Social Support, and Mortality Among Older People in Japan. *The Journal of Gerontology* 49 (1), pp.S3-S13.

Swartley, W. M. (2006). *Covenant of Peace: The Missing Piece in New Testament Theology and Ethics.* Grand Rapids: Eerdmans.

Swinton, J. (2000). *From Bedlam to Shalom: Towards a Practical Theology of Human Nature, Interpersonal Relationships and Mental health Care.* New York: Peter Lang Press.

Szyf, M. (2011). The Early Life Social Environment and DNA Methylation: DNA Methylation Mediating the Long-Term Impact of Social Environments Early in Life. *Epigenetics* 6 (8), pp.971-978.

Tattam, H. (2010). Storytelling as Philosophy: The Case of Gabriel Marcel. *Romance Studies* 28 (4), pp.223-234.

Tattam, H. (2013). *Time in the Philosophy of Gabriel Marcel.* London: MRHA.

Taylor, M. C. (2001). *The Moment of Complexity: Emerging Network Culture.* Chicago: University of Chicago Press.

Taylor, S. E. *et al.* (2008). Neural Bases of Moderation of Cortisol Stress Responses by Psychosocial Resources. *Journal of Personality and Social Psychology* 95 (1), pp.197-211.

Theorell, T. *et al.* (1995). Social Support and the Development of Immune Function in Human Immunodeficiency Virus Infection. *Psychosomatic Medicine* 57, pp.32-36.

Theorell, T., Orth-Gomer, K. and Eneroth, P. (1990). Slow-Reacting Immunoglobulin in Relation to Social Support and Changes in Job Strain: a Preliminary Note. *Psychosomatic Medicine* 52, pp.511-516.

Thiselton, A. C. (2005). Human Being, Relationality and Time in Hebrews, 1 Corinthians and Western Traditions. *Ex auditu* 13, pp.76-95.

Thoits, P. A. (1995). Stress, Coping, and Social Support Processes: Where Are We? What Next? *Journal of Health and Social Behavior* 35, pp.53-79.

Thoits, P. A. (2011). Mechanisms Linking Social Ties and Support to Physical and Mental Health. *Journal of Health and Social Behavior* 52 (2), pp.145-161.

Thompson Klein, J. (2004). Prospects for Transdisciplinarity. *Futures* 36 (4), pp.515-526.

Thompson, T. R. (2006). Nineteenth Century Kenotic Christology: The Waxing, Waning and Weighing of a Quest for a Coherent Orthodoxy. In: Evans, C. S. (ed.) *Exploring Kenotic Christology: The Self-Emptying of God*. Oxford: OUP, pp.74-111.

Tillich, P. (1951). *Systematic Theology: Vol 1.* Chicago: University of Chicago Press.

Timimi, S. (2004). Rethinking Childhood Depression. *BMJ* 329 (7479), pp.1394-1396.

Tonstad, L. M. (2010). Sexual Difference and the Trinitarian Death: Cross, Kenosis and Hierarchy in the Theo-Drama. *Modern Theology* 26 (4), pp.603-631.

Torrance, A. J. (1996). *Persons in Communion: An Essay on Trinitarian Description and Human Participation.* Edinburgh: T. & T. Clark.

Trief, P. M. *et al.* (2006). Marital Quality and Diabetes Outcomes: The IDEATel Project. *Families, Systems and Health* 24 (3), pp.318-331.

Troeltsch, E. (1912/1992). *The Social Teaching of the Christian Churches.* English Translation ed. Louisville: Westminster John Knox Press.

Turcescu, L. (2002). "Person" versus "Individual", and Other Modern Misreadings of Gregory of Nyssa. *Modern Theology* 18 (4), pp.527-539.

Turella, L. *et al.* (2009). Mirror Neurons in Humans: Consisting or Confounding Evidence? *Brain and Language* 108 (1), pp.10-21.

Turnbull, A. V. and Rivier, C. L. (1999). Regulation of the Hypothalamic-Pituitary-Adrenal Axis by Cytokines: Actions and Mechanisms of Action. *Physiological Reviews* 79 (1), pp.1-71.

Turner, V. (1967). *The Forest of Symbols: Aspects of Ndembu Ritual.* New York: Cornell University press.

Uchino, B. N. (2006). Social Support and Health: A Review of Physiological Processes Potentially Underlying Links to Disease Outcomes. *Journal of Behavioral Medicine* 29 (4), pp.377-387.

Uchino, B. N. (2009). Understanding the Links Between Social Support and Physical Health: A Life-span Perspective with Emphasis on the Separability of Perceived and Received Support. *Perspectives on Psychological Science* 4 (3), pp.236-255.

Uchino, B. N., Cacioppo, J. T. and Kiecolt-Glaser, J. K. (1996). The Relationship Between Social Support and Physiological Processes: a Review with Emphasis on Underlying Mechanisms and Implications for Health. *Psychological Bulletin* 119 (3), pp.488-531.

Uchino, B. N., Uno, D. and Holt-Lunstad, J. (1999). Social Support, Physiological Processes, and Health. *Current Directions in Psychological Science* 8 (5), pp.145-148.

Uchino, B. N. *et al.* (2004). Heterogeneity in Social Networks: A Comparison of Different Models Linking Relationships to Psychological Outcomes. *Journal of Social and Clinical Psychology* 23 (2), pp.123-139.

Uchino, B. N. *et al.* (2012). Social Support and Immunity. In: Segerstrom, S. C. (ed.) *The Oxford Handbook of Psychoneuroimmunology*. Oxford: OUP, pp.214-233.

Uno, D., Uchino, B. N. and Smith, T. W. (2002). Relationship Quality Moderates the Effect of Social Support Given by Close Friends on Cardiovascular Reactivity in Women. *International Journal of Behavioral Medicine* 9 (3), pp.243-262.

Uvnas-Moberg, K. (1997). Oxytocin Linked Antistress Effects—the Relaxation and Growth Response. *Acta Physiologica Scandinavica* 640 (suppl), pp.38-42.

Uvnas-Moberg, K. (1998). Oxytocin May Mediate the Benefits of Positive Social Interaction and Emotions. *Psychoneuroendocrinology* 23, pp.819-835.

van Huyssteen, J. W. (1989). *Theology and the Justification of Faith: Constructing Theories in Systematic Theology.* Grand Rapids: Eerdmans.

van Huyssteen, J. W. (1998a). *Duet or Duel? Theology and Science in a Postmodern World.* London: SCM Press.

van Huyssteen, J. W. (1998b). Postfoundationalism in Theology and Science: Beyond Conflict and Consonance. In: Gregersen, N. H. and Van Huyssteen, J. W. (eds.) *Rethinking Theology and Science: Six Models for the Current Dialogue*. Grand Rapids, Michigan: Eerdmans, pp.13-50.

van Huyssteen, J. W. (1999). *The Shaping of Rationality: Towards Interdisciplinarity in Theology and Science.* Grand Rapids, Michigan/Cambridge, UK: Eerdmans.

van Huyssteen, J. W. (2000). Postfoundationalism and Interdisiplinarity: A Response to Jerome Stone. *Zygon: Journal of Religion & Science* 35 (2), p.427.

van Huyssteen, J. W. (2006). *Alone in the World? Human Uniqueness in Science and Theology.* Hardback Ed. Grand Rapids, Michigan/Cambridge, UK: Eerdmans.

van Huyssteen, J. W. (2008). Primates, Hominids and Humans; From Species Specificity to Human Uniqueness? A Response to Barbara J. King, Gregory R. Peterson, Wesley J. Wildman, and Nancy R. Howell. *Zygon* 43 (2), pp.505-525.

van Orden, G. C. and Paap, K. R. (1997). Functional Neuroimages Fail to Discover Pieces of Mind in the Parts of the Brain. *Philosophy of Science* 64, pp.S85-S94.

Vanstone, W. H. (1977). *Love's Endeavour, Love's Expense: The response of Being to the Love of God.* London: Darton, Longman and Todd.

Vedhara, K. *et al.* (1999). Chronic Stress in Elderly Carers of Dementia Patients and Antibody Response to Influenza Vaccination. *The Lancet* 353 (9153), pp.627-631.

Vogel, A. C. *et al.* (2010). Development of the Brain's Functional Network Architecture. *Neuropsychology Review* 20 (4), pp.362-375.

Vogt, T. M. *et al.* (1992). Social Networks as Predictors of Ischemic Heart Disease, Cancer, Stroke and Hypertension: Incidence, Survival and Mortality. *Journal of Clinical Epidemiology* 45 (6), pp.659-666.

von Balthasar, H. U. (1986). In Retrospect. In: Riches, J. (ed.) *The Analogy of Beauty: The Theology of Hans Urs von Balthasar*. Edinburgh: T&T Clark Ltd, pp.194-221.

von Balthasar, H. U. (1988-98). *Theo-drama: Theological Dramatic Theory, Volumes 1-5.* San Fancisco: Ignatius Press.

von Balthasar, H. U. (1990). *Mysterium Paschale.* ET Ed. Edinburgh: T&T Clark Ltd.

von Balthasar, H. U. (1991). A Résumé of my Thought. In: Schindler, D., L (ed.) *Hans Urs von Balthasar: His Life and Work*. San Francisco: Ignatian Press, pp.1-5.

von Balthasar, H. U. (1993). *Theo-Drama: Theological Dramatic Theory, Vol. 2: c.* San Fancisco: Ignatius Press.

von Bertanlaffy, L. (1975). *Perspectives on General Systems Theory.* New York: George Braziller.

von Rad, G. (1962/2001). *Old Testament Theology: The theology of Israel's historical traditions.* Louisville: Westminster John Knox Press.

von Rad, G. (1964). *The Divine Likeness in the Old Testament.* In: Kittel, G., ed. *Theological Dictionary of the New Testament. Vol II.* Grand Rapids: Eerdmans.

von Rad, G. (1973). *Genesis: A Commentary* Revised Ed. Philadelphia: John Knox Press.

von Rad, G. (1985). *Shalom in the Old Testament.* In: Bromley, G. W., ed. *Theological Dictionary of the New Testament.* Grand Rapids: Eerdmans.

Vul, E. *et al.* (2009). Puzzlingly High Correlations in fMRI Studies of Emotion, Personality, and Social Cognition. *Perspectives on Psychological Science* 4 (3), pp.274-290.

Wade, D. T. and Halligan, P. W. (2004). Do Biomedical Models of Illness Make for Good Healthcare Systems? *BMJ* 329 (7479), pp.1398-1401.

Walburn, J. *et al.* (2009). Psychological Stress and Wound Healing in Humans: A Systematic Review and Meta-analysis. *Journal of Psychosomatic Research* 67 (3), pp.253-271.

Ward, G. (1999). Kenosis, Death, Discourse and Resurrection *Balthasar at the End of Modernity*. Edinburgh: T&T Clark Ltd, pp.15-68.

Wass, S. (2011). Distortions and Disconnections: Disrupted Brain Connectivity in Autism. *Brain and Cognition* 75 (1), pp.18-28.

Waxler-Morrison, N. *et al.* (1991). Effects of Social Relationships on Survival for Women with Breast Cancer: A Prospective Study. *Social Science & Medicine* 33 (2), pp.177-183.

Weaver, I. C., Mearney, M. J. and Szyf, M. (2006). Maternal Care Effects on the Hippocampal Transcriptome and Anxiety-Mediated Behaviors in the Offspring that are Reversible in Adulthood. *PNAS* 103 (9), pp.3480-3485.

Weissman, M. M. (1987). Advances in Psychiatric Epidemiology: Rates and Risks for Major Depression. *American Journal of Public Health* 77 (4), pp.445-451.

Welin, L. *et al.* (1985). Prospective Study of Social Influences on Mortality. *The Lancet* 325 (8434), pp.915-918.

Welker, M. (1999). *Creation and Reality.* Minneapolis: Fortress Press.

Welker, M. (2006). Science and Theology: Their Relation at the Beginning of the Third Millenium. In: Clayton, P. and Simpson, Z. (eds.) *The Oxford Hand book of Religion and Science*. Oxford: OUP, pp.551-561.

Westermann, C. (1972). Salvation and Healing in the Community: the Old Testament Understanding. *International Review of Mission* 61 (241), pp.9-19.

Westermann, C. (1984). *Genesis 1-11: A Commentary.* ET ed. Minneapolis: Augsburg.

Westermann, C. (1992). Peace [Shalom] in the Old Testament. In: Yoder, P. B. and Swartley, W. M. (eds.) *The Meaning of Peace: Biblical Studies*. Rev ed. Louisville: Westminster John Knox, pp.14-48.

Westhelle, V. (2000). Theological Shamelessness? A Response to Arthur Peacocke and David A. Pailin. *Zygon* 35 (1), p.165.

Westphal, M. (2002). Preface. In: *Creative Fidelity*. New York: Fordham University Press, pp.ix-xvii.

Wheeler, A. *et al.* (2011). Caucasian Infants Scan Own- and Other-Race Faces Differently. *PLoS ONE* 6 (4), p.e18621.

Whisman, M. A. and Sbarra, D. A. (2012). Marital Adjustment and Interleukin-6 (IL-6). *Journal of Family Psychology* 26 (2), pp.290-295.

Wicker, B. *et al.* (2003a). Both of Us Disgusted in My Insula: The Common Neural Basis of Seeing and Feeling Disgust. *Neuron* 40 (3), pp.655-664.

Wicker, B. *et al.* (2003b). Being the Target of Another's Emotion: a PET Study. *Neuropsychologia* 41 (2), pp.139-146.

Wickrama, K. A. S. *et al.* (1997). Marital Quality and Physical Illness: A Latent Growth Curve Analysis. *Journal of Marriage and Family* 59 (1), pp.143-155.

Wigley, S. (2010). *Balthasar's Trilogy.* London/New York: Continuum

Wild, B., Erb, M. and Bartels, M. (2001). Are Emotions Contagious? Evoked Emotions while Viewing Emotionally Expressive Faces: Quality, Quantity, Time Course and Gender Differences. *Psychiatry Research* 102 (2), pp.109-124.

Wild, B. *et al.* (2003). Why are Smiles Contagious? An fMRI Study of the Interaction Between Perception of Facial Affect and Facial Movements. *Psychiatry Research: Neuroimaging* 123 (1), pp.17-36.

Wilkinson, R. and Pickett, K. (2009). *The Spirit Level.* London: Allen Lane.

Williams, R. (2004). Balthasar and the Trinity. In: Oakes, E. T. and Moss, D. (eds.) *The Cambridge Companion to Hans Urs von Balthasar*. Cambridge: CUP, pp.37-50.

Williams, R. B. *et al.* (1992). Prognostic Importance of Social and Economic Resources Among Medically Treated Patients With Angiographically Documented Coronary Artery Disease. *JAMA* 267 (4), pp.520-524.

Wills, T. A. and Shinar, O. (2000). Measuring Perceived and Received Social Support. In: Cohen, S., Gordon, L. and Gottlieb, B. (eds.) *Social Support Measurement and Intervention: A Guide for Health and Social Scientists*. New York: OUP, pp.86-135.

Wilson, M. (1975). *Health is for People.* London: Darton, Longman and Todd Ltd.

Wilson, R. (2005). *Genes and the Agents of Life: The Individual in the Fragile Sciences.* Cambridge: CUP.

Winnicott, D. W. (1965). *The Maturational Processes and the Facilitating Environment.* New York: International Universities Press.

Winston, J. S., O'Doherty, J. and Dolan, R. J. (2003). Common and Distinct Neural Responses During Direct and Incidental Processing of Multiple Facial Emotions. *NeuroImage* 20 (1), pp.84-97.

Womelsdorf, T. *et al.* (2007). Modulation of Neuronal Interactions through Neuronal Synchronization. *Science* 316 (5831), pp.1609-1612.

Wood, R. E. (1999). The Dialogical Principle and the Mystery of Being: The Enduring Relevance of Martin Buber and Gabriel Marcel. *International Journal for Philosophy of Religion* 45 (2), pp.83-97.

Woodward, A. L. *et al.* (2009). The Emergence of Intention Attribution in Infancy. *The Psychology of Learning and Motivation*. Vol. 51. Burlington: Academic Press, pp.187-222.

Zautra, A. J. *et al.* (1998). An Examination of Individual Differences in the Relationship between Interpersonal Stress and Disease Activity among Women with Rheumatoid Arthritis. *Arthritis & Rheumatism* 11 (4), pp.271-279.

Zizioulas, J. D. (1985). *Being as Communion: Studies in Personhood and the Church.* Cresswood, New York: St Vladimir's Seminary Press.

Zizioulas, J. D. (1995). The Doctrine of the Holy Trinity: The Significance of the Cappadocian Contribution. In: Schwobel, C. (ed.) *Trinitarian Theology Today: Essays on Divine Being and Action*. Edinburgh: T & T Clark, pp.44-60.

Zizioulas, J. D. (2006). *Communion and Otherness.* London: T&T Clark.