Theorising self-repairers' worldview-personhood to advance new thinking on extended product lifetimes (pre-production version). International Journal of Consumer Studies, accepted 20th February 2020.

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Abstract

The ecological and societal problems caused by product obsolescence and consumerism in modern economies constitute a 'wicked human-made problem' of significant magnitude. Current (old) ways of thinking cannot address these problems. Accordingly, in this paper, we critically explore the novel idea of integrated personhood and worldviews to theorise research on self-repairers and their repair behaviours to extend product lifetimes. We conducted a structured and systematic review of published work (n=183) to identify the conceptual content of the field to inform our theorisation. Our findings highlight three key issues. Firstly, constricted theorisation undermines understanding of self-repairers and their product lifetime extension (and spillover) behaviours. Secondly, the underlying conceptual complexity is typically underestimated. Thirdly, the dominance of voluntarist and deterministic studies impedes new directions in research. From our review, an integrated worldview-personhood framework emerges that can deepen understanding of avant-garde self-repairers' engagement with product lifetimes.

Keywords:

Product lifetimes; product repair; personhood; worldview; circular economy

1. Introduction

Modern society has embarked on an unsustainable production and consumption path that both normalises and encourages product obsolescence (Cooper, 2004, 2005; Dermody *et al*., 2015, 2018; Echegaray, 2016; Guiltinan, 2009). This mind-set of endless streams of consumerism and associated resource flow from extraction to consumption and disposition (waste) is characteristic of linear economies in modern developed nations, where manufacturers design products with shortened lifespans, as throwaway lifestyle accessories. This will be exacerbated by the forecasted increase in the size of the affluent middle-classes globally, from the current 1.8 billion people to 4.9 billion by 2030 (Kharas, 2017), which will significantly expand these market practices in emerging economies too (Dermody *et al*., 2018; Echegaray, 2016). As incomes rise, evidence shows the spending of the affluent consumer-classes on new products increases and becomes more impulsive and less evaluative of products attributes, for example their durability (Evans and Cooper, 2010). Studies show consumers are complicit in the excessive (single) use and depletion of resources through their expressed satisfaction with product lifetimes that are not extended (Gnanapragasam *et al*., 2017), and their limited concern or comprehension about the environmental consequences of products with short product lifecycles (Cox *et al.,* 2013; Lilly *et al*., 2013; Hennies and Stemminger, 2016). Particularly problematic examples of this include electronic waste (Echegaray and Hansstein, 2017; Park 2010); the degradation of the quality of raw materials in the recycling process (downcycling), rendering them less useful for reuse (Braungart and McDonough 2002); high levels of plastic waste to landfill because of recycling difficulties (Geyer, *et al.,* 2017); and quality issues with products offered for reuse, *e.g*., the decline in quality of 'donated' fast-fashion and flat-pack furniture (Brook Lyndhurst *et al.,* 2009).

Fundamentally, the ecological and societal problems triggered by this obsolescence 'throwaway' mind-set among affluent consumers constitute a 'wicked human-made problem'

of significant magnitude for present and future generations. Addressing these unsustainable practices requires a societal cultural shift to a circular economic model, where consumption behaviour is characterised by minimal use of toxic materials and energy resources, and continuing use of products to extend their lifespans, for example through reuse or repair. Repairing products extends these lifetimes, reducing the use of resources in the production process, and waste and pollution outputs (Bittar, 2018; Bortoleto, 2016; Cooper, 2010; ERM, 2011; Graham and Thrift, 2007; Salvia *et al.,* 2015). Thus, by extending product lifetimes, product repair helps to advance a more sustainable circular economy (Cooper, 2010; Van Nes and Cramer, 2005). Studies, however, show consumers have less appetite for reusing products, e.g. actually buying pre-owned, although they do express a willingness to consider buying them (Cox *et al*., 2010; European Commission, 2014; Bovea *et al*., 2016). Furthermore, while manufacturers of household products do build a repair option into their product design, this is primarily repairing broken products for resale as pre-owned, when consumers buy a new replacement product (Ellen MacArthur Foundation, 2012; WRAP, 2013). With a greater emphasis on new product purchase, this business approach to extending product lifetimes may be undermining mainstream consumer engagement with repair initiatives, hence its value is questionable (Gregson *et al.,* 2009).

Consequently, this conversion towards less wasteful lifestyles that embrace extended product lifespans through repair and reuse is challenging (Cooper, 2010; Dermody *et al.,* 2015). The 'throwaway consumerist culture' among the global affluent consumer-classes is exacerbated by their impulsive buying of new products to follow latest trends, with little regard for resource use or the ensuing waste generated (Cooper, 2008; Cox *et al*., 2013; Dermody *et al*., 2015, 2018; Evans and Cooper 2010; Lipovetsky, 2002; Park, 2010). While it is critical that consumerist lifestyles and business thinking and action shifts away from obsolescence towards extending product lifecycles, the difficulties involved in achieving this are

multifarious and complicated. Meanwhile, the generation of waste from these unsustainable production-consumption practices continues to escalate at record levels (OECD 2015).

Accordingly, we recognise that this 'wicked' obsolescence mind-set confronting modern societies cannot be addressed within current (old) ways of thinking. This is because extending the lifetime of consumption goods challenges one of the fundamental pillars of thinking in economics, namely, that higher production and consumption of goods and services are beneficial as the engines of economic growth and societal well-being.

Thus, it is interesting to observe the emergence of avant-garde consumer groups who display unorthodox less wasteful behavioural lifestyles that embrace product stewardship and longevity of product lifetimes. 'Self-repairers' are a notable example. They are emerging from the 'fixer movement', aided by innovative social, community and online enterprises offering self-repair services (Charter and Keiller, 2014, 2016; Gnanapragasam *et al*., 2017; Gregson *et al.,* 2009; Raihanian *et al.,* 2016; Watson, 2008). Examples include *'repair café'* workshops with experts (Repair Café International 2015 https://repaircafe.org), '*The Restart Project'* (https://therestartproject.org/restart-your-electronics/), and varied online tutorials/networks *e.g., 'IFixit'* (www.ifixit.com).

The value of these repair enterprises to extend product lifetimes is recognised within more contemporary EU governmental policy thinking on product lifetimes (*e.g*. waste prevention programmes of OECD countries and taxation policy: DEFRA, 2013; Dehoust *et al.,* 2013; Martin, 2016). Reflective of the arguments put forward by Boons *et al.* (2013), Dermody *et al.,* (2015), Montalvo (2014), and Montalvo *et al.,* (2016), increasing understanding of self-repairers may act as a catalyst for creative new thinking on future design and lifestyle dimensions of product lifetimes (*e.g*. 'personal manufacturing', 'additive manufacturing' to support retro-repair and 'smart circular manufacturing'). In turn, this can progress a societal cultural shift to a circular model.

This need for new thinking to engender repair behaviours to extend product lifetimes underlies our paper. Currently, however, few theoretically informed research studies exist on self-repairers, particularly their self-repair worldview-personhood identities. Yet it is widely recognised that researching identity is significantly important in furthering understanding of consumers' pro-environmental behaviour choices (Dermody *et al*., 2015, 2018; Oyserman and James, 2008; van der Werff, Steg and Keizer, 2014; Whitmarsh and O'Neill, 2010). Thus, in this paper we construct and evaluate the novel integrated worldview-personhood framework. Further, we consider if and how this group might act as a catalyst in directing debate and new thinking on policy interventions and business innovation.

2. Research Methodology

We conducted a structured and systematic review of theory-driven published work on obsolescence, waste reduction and prevention, repair and product lifetimes, and pro-environmental behaviour and sustainable consumption. Our purpose was to identify the conceptual content of this field to contribute to its theorisation (Ahi and Searcy, 2013; Meredith, 1993; Seuring and Müller, 2008). We prioritised outputs within a 19-year period (2000 to 2019). This reflects limited behaviour and theoretically-driven subject material prior to 2000, and a quickening developing field of environmental, waste and sustainability scholarship. This culminated in a dataset of 183 publications (see table 2, supplementary document).

Our evaluation prioritised theory-driven outputs written in English in peer-reviewed journals, accompanied by specialist books, chapters, peer-reviewed conference papers and commissioned academic reports. All selected outputs focused on theorising consumers and their behaviour within our appraisal criteria. Hence, we selected outputs that aimed to advance theory and rejected descriptive non theory-building outputs. In-line with other studies (Seuring

and Müller, 2008), we classified outputs using theoretical orientation, research methodologies, and behaviours (see definitions, supplementary document). Where outputs contained multiple constructs, we used author(s) stated theoretical contribution for categorisation. Published work focusing on business attitudes and behaviours and policy-making were excluded.

We used a structured keyword search with databases provided by major publishers, e.g. Elsevier (www.sciencedirect.com), Emerald (www.emeraldinsight.com), and library services, e.g. EBSCO (www.ebsco.com). Our search used the following keywords: obsolescence; materialism; consumerism; repair; self-repairers; product lifetimes; sustainable consumption; pro-environmental (behaviour); waste reduction; and waste prevention. Outputs were included or excluded following a content check. To increase reliability of the dataset, two members of the research team assessed these outputs. References were tracked within the selected outputs; however, no significant additions were added, indicating the validity of the sampled outputs.

We recognise we might have overlooked important outputs; for example, outputs that have not undergone peer review. On balance, we considered the judgements of academic experts to be more important than breadth of outputs in strengthening the objectivity and accuracy of our study. There is a risk that researchers might analyse the content of the outputs differently, thereby compromising the reliability of the research study. Accordingly, to strengthen research reliability, two members of the research team worked together to analyse the data outputs, discussing and resolving any alternate interpretations. This is considered 'best practice' in structured systematic reviews.

3. Findings and Discussion

3.1 Descriptive analysis

We present our descriptive data of the theoretical orientations, methodologies, and behaviour types in table 2 and figures 2a-2e (supplementary document). With respect to the ten theoretical

areas identified in the dataset (figure 2a), attitude-behaviour studies dominated (n=50, 27.3%), with the theory of planned behaviour featuring strongly (see table 2). The next largest theories were values (n=25, 13.7%), norms (n=21, 11.5%) and obsolescence/lifetimes (n=16, 8.7%). Identity and personhood constituted 9.3% (n=17) of the dataset, and worldviews only 3.8% (n=7). Survey methods featured very heavily across the majority of the ten theoretical orientations (n=106, 57.9%); however, it was notably high in the attitude and behaviour data (n=42/50, 84%), further supported by experiments, field studies, mathematical modelling and quantitative mixed methods (figs. 2b, 2d). The interpretative methodologies were less well represented within these theoretical domains, with interviews being the most widely spread amongst them (fig. 2d). They were most evident within 'alternative discourses', which is unsurprising given its remit (fig. 2d). From our thirteen identified behaviours, our findings show the prominence of broad behavioural categories (fig. 2c), namely, pro-environmental behaviours (n=62, 34%) and sustainable consumption behaviours (n=46, 25.1%), followed by waste reduction/prevention (n=25, 13.7%). Only 3.3% (n=6) focused directly on repair behaviours. These behaviours dominated the majority of the theoretical orientations, notably attitudes and behaviour. Repair behaviours were most visible within obsolescence/lifetimes (fig. 2e).

Three primary issues emerge from our descriptive analysis, combined with our appraisal of our data's conceptual content. Firstly, there is a lack of theorisation of self-repairers and their behaviours. Secondly, researchers' recognition of the complexity in conceptualising and/or operationalising this research is not always evident. Thirdly, the existing evidence base is predominantly voluntarist and deterministic, with a strong academic bias towards attitude and behaviour investigations. From our review, the need for a more dynamic conceptual approach emerges. We suggest personhood identity integrated with the

social and cultural dimensions of worldviews as an approach that is able to address these three issues.

3.2 Limited Theorisation of Self-Repairers

Our appraisal of existing evidence highlights narrower theorisation of consumers' engagement with product lifetimes, compared with wider sustainable consumption buying behaviours. Specifically, as table 2 and figures 2a, 2c & 2e (supplementary document) show, few academic studies have focused on self-repairers and their repertoire of pro-environmental behaviours embracing stewardship for longer product lifetimes and potentially their spillover and rebound behaviours *e.g*. consumption curtailment and waste prevention behaviours. The weaker theorisation of this data within the obsolescence/lifetimes cluster (compared with our appraisal of our data in the other nine theoretical orientations) compounds this. Consequently, there is superficial understanding at best of 'what', 'how' and 'why' self-repairers engage with household product repair, self-repair, product lifetimes and waste prevention and sustainable consumption behaviours more broadly. This is problematic given the high importance of repair in extending lifetimes to European policy thinking and product design innovation, and its prominence as a key area for further research (Bortoleto, 2016; Brook Lyndhurst *et al*., 2009; Cooper, 2010; Cox *et al.*, 2013; Den Hollander *et al*., 2017; Mont, 2008; Montalvo *et al*. 2016; Salvia *et al.*, 2015; Tukker, 2015).

3.3 Research Complexity

Our appraisal of current research also reveals the conceptual complexity involved in gaining understanding of consumer (dis)engagement with product lifetimes (including obsolescence), sustainability and waste prevention behaviours. This includes the inherent multidimensionality and impermanence of elements of these behaviours and limited consumer understanding of

what they are and how they connect with their endeavours to help minimise environmental problems (Ahi and Searcy, 2013; Bortoleto, 2016; Cox *et al.,* 2010; Dermody *et al.,* 2015; Ferrara and Missios, 2012; Salvia *et al.,* 2015; Wang and Hazen, 2016). These behaviours are thus difficult to measure (Coggins, 2001). To some degree, this reflects modifications to the Theory of Planned Behaviour (discussed in 3.4). This complexity also explains why this research does not always translate easily into policy-making, and thus why policy-makers often misunderstand how consumers (dis)engage with this obsolescence/waste prevention environmental agenda (Bortoleto, 2016; Ferrara and Missios, 2012; Montalvo *et al*. 2016).

3.4 Voluntarist and Deterministic Research Orientation

The theoretical, methodological and behavioural biases in our data (figs 2a-e, supplementary document) highlight the voluntarist (consumer choice making) and deterministic (structural forces) foci to identify and predict 'drivers of behaviour' that dominates this research field. As a result, key 'why' questions are largely ignored in research designs and given superficial attention in research conclusions (exceptions include Cherrier, 2012; Dermody *et al*. 2015; Whitmarsh and O'Neill, 2010). Hence, our study shows there is significant emphasis on data generation to identify internal and external drivers of product lifetimes/pro-environmental/waste/sustainable consumption choice making. This emphasis has led to the dominance of attitude-behaviour relationship modelling to explain and predict a very broad range of pro-environmental, sustainable consumption and waste reduction/prevention behaviours (see table 2 and figures 2a, 2d & 2e, supplementary document). Ajzen's (1991) Theory of Planned Behaviour is one of the most extensively used and influential theories explaining the relationship between attitudes and behaviour. It maintains that a strong intention to behave in a particular way, *e.g*. repairing a household product, will increase the likelihood of that behaviour (repair) occurring because individuals will increase their effort to perform it,

e.g., attending a class at a repair café. Gnanapragasam *et al*. (2017) found this attitude-behaviour connection among self-repairers who have experience of self-repairing home electronics. However, the explanatory credibility of the Theory of Planned Behaviour is questionable because of its conceptual narrowness and disputed direct relationship between attitudes and behaviour in explaining pro-environmental behaviours (Davies *et al.,* 2002; Kaiser *et al.,* 2005). This is evident among consumers who express positive attitudes with a strong intention to take broken products to be repaired, accompanied by low behavioural action in actually doing so (Bovea *et al.* 2016; European Commission, 2014; Hennies and Stemminger, 2016; Pérez-Belin *et al*., 2017). Additionally, the influence of this relationship on repair choice-making depends on whether the product was expensive to buy, or inexpensive to replace (Cox *et al.* 2013; Gnanapragasam *et al*., 2017; Pérez-Belin *et al*., 2017); strong/weak psychological attachment (Pierce *et al.*, 2003; Shu and Peck, 2011); knowledge about repair options (Cox *et al.,* 2013) and built-in physical/technological obsolescence (Guiltinan, 2009); and the perceived high financial/time repair cost (Lilly *et al*. 2013). Accordingly, additional 'influencers' have been added to improve the predictive strength of the attitude-behaviour relationship. These include personal norms and identity (Nigbur *et al*., 2010), social and personal norms (Liobikienė *et al*., 2016; Onwezen *et al*., 2013), environmental concern, altruism, and context (Bortoleto, 2016), and identity (Thorbjørnsen *et al.*, 2007). However, these additions risk rendering the model's structure unstable, and thus the integrity of the research data it generates (Bagozzi, 1992). Given the reliance on this theory, there is potential conceptual restriction of product lifetimes research.

This research disposition to model behavioural cause and effect is equally evident in studies applying alternate theoretical frameworks, albeit many interlink with the attitude-behaviour relationship (examples include Cho *et al*., 2013; Best and Mayerl, 2013; Leary *et al*., 2014; Ertz *et al*., 2016; Steg *et al*., 2014 and Dermody *et al*., 2018).

3.5 Integrating Worldview-Personhood as a Dynamic Conceptual Approach

Our critical appraisal signals the need for a more dynamic conceptual approach. Integrating personhood identity with the social and cultural dimensions of worldviews offers a promising framework that is capable of overcoming the restrictions associated with the currently predominant research orientation. Identity is distinctive for its important contribution to understanding pro-environmental behaviour choices, (for examples see table 2, supplementary document). These studies illustrate how identity functions as a fluid organizing system in constructing who a person was, is and could become in the future (Oyserman and James, 2008). Accordingly, they show the flexibility of identity in adapting to different expressions of pro-environmental behaviours and sustainable consumption, distinctive cultures and wide-ranging research methods spanning research paradigms; thus overcoming the rigidity problems inherent in attitude-behaviour modelling. For example, the environmentally friendly self-concept underlying pro-environmental self-identity embraces consumers' symbolical expressiveness and reflects mainstream socio-cultural forces (Dermody *et al*., 2018). Similarly, personhood embodies social connectivity and reflexivity, with scope for creative research approaches (Cherrier, 2012). To date, however, these identity studies have not extended to self-repairers, product lifetimes or waste prevention.

Overall, the conceptual and methodological gaps identified from our review strongly signal the need for new ways of theorising research on self-repairers. Potentially, identity theory, premised on a dynamic, dialectical interpretative research approach, can make a major contribution to advancing new knowledge. This novel thinking on this 'wicked problem' can begin to redress increasing concern that existing research studies are not living up to unfolding global environmental challenges (Dermody *et al*., 2015; Montalvo *et al*., 2016).

4. The Integrated Worldview-Personhood Conceptual Framework

In considering this need for new thinking, we have brought together two novel areas of identity construction to inform our conceptualisation of transformational self-repairers and their behaviour. These are personhood, as a reflexive self (Cherrier 2012), underpinned by socio-culturally constructed consumption-based pro-environmental self-identity **(**Dermody *et al.*, 2015, 2018), and meanings and meaning making embedded in worldviews (Hedlund-de Witt *et al.*, 2014).

Accordingly, we have created an integrated framework to theorise the identity archetype of self-repairers, to more deeply understand their engagement with self-repair and product lifetimes, and their spillover sustainable consumption/waste prevention behaviours too. This novel framework facilitates a dialectic approach, enabling researchers to seek complex answers to difficult questions without being constrained by a normative-deterministic 'explanation' of self-repairers and their behaviours, which characterises many other studies in the pro-environmental field (see table 2, supplementary document). It also embraces contemporary understanding of consumer's choice-making occurring within a social not individualised context. Our integrated worldview-personhood framework is visualised in figure 1. Its dialectic, dynamic character is reflected within the merging of the 'circles of ideas' as they flow and amalgamate to unite within the worldview-personhood of self-repairers.

Insert figure 1 about here.

4.1 The Personhood and Worldviews Constructs

Personhood is fundamentally 'a sense of being a person interconnected with other persons' (Buber, 2002; Gillet and Peacocke, 1987; Scott, 2014). As Jenkins (1996, p.52) explains,

personhood is 'the individual's reflexive sense of her own particular identity, constituted vis a vis others in terms of similarities and differences, without which she would not know who she was and would not be able to act.' This intersubjectivity of personhood highlights interdependency between persons and context. Hence, a person is understood and constructed from the societal and cultural forces within their social context (Bailie, 2006; Buber, 2002; Cherrier, 2012; Gaylin and Jennings, 2003; La Fontaine, 1985). Social context is thus fundamental to the concept of personhood. Accordingly, Buber (2002) asserts isolated individuals are a fallacy; they are driven by their desire to connect with the world, ('a chain of being'), through their interactions with others or objects. Premised on social interactions, personhood is therefore distinctive from the concept of individual self that characterises much pro-environmental and sustainable consumption research (see table 2, supplementary document). Thus, self-repairers' perceptions of product lifetimes, sustainability and waste prevention are appraised, experienced and appropriated within the social context of their social roles and relationships within their life-worlds.

Personhood possesses distinctive objective and subjective elements (Fortes, 1973). Its objective dimension reflects the outer persona presented to the world; a persona that is culturally objectified in complying with social and cultural rules, roles and representations, (Du Gay, 2004, 2007), including self-repair product extension behaviours. Subjective personhood entails the adoption of habits and dispositions to represent the essence of a person as different from other persons (Du Gay *et al.*, 1996). Thus, a person knows that they are the person they are expected to be, in given situations, according to socially constructed roles (Fortes, 1973). There is likely to be less resistance to sustainable consumption and lifetime extension and waste prevention repair behaviours operating within this social system; however, resistance will occur if operating outside it because of the significant threat to consumers' personhood (Cherrier, 2012). A small number of studies have explored sustainable consumption from this

sociocultural perspective. For example, Autio *et al*., (2009) examined the construction of popular culture themed sustainable consumption identities, *e.g*., environmental hero and anarchist. Cherrier (2012) appraised sustainable consumption personhood experiences within the social space of consumers, concluding that sustainable consumption is part of the same social-cultural system that connects people with one another. Connolly and Prothero (2003, 2008) evaluated 'material greens' shaped by the marketplace and commodity discourse. Berkin *et al.,* (2006) explored empowered collective communities, and Varul (2009) observed 'ethical selving' from increased individualization and the global consumer culture.

Exploring personhood within a product obsolescence and extended lifetimes context therefore requires understanding the worldview societal and cultural forces underlying the reflexive identity navigation, reorientation and practices of self-repairers 'meaning-making' within their life-worlds. This meaning making can stimulate reflexivity on their ontological (nature of reality), epistemological (ways of knowing), axiological (good life – morals, ethics, aesthetics), anthropological (who the person is and their purpose), and societal (how society should be organised to address problems) – all embedded within their worldview of what it means to be a self-repair person within the social and cultural world. Worldview is thus an important element of our proposed integrative research framework because it enables exploration of the interaction between beliefs, values and traditions underlying personhood. Furthermore, it assists a person's interpretation, activation and co-creation of their reality (De Vries and Peterson, 2009; Hedlund-de-Witt, 2012, 2013; Hedlund-de-Witt *et al.*, 2014; Johnson *et al.,* 2011). Assimilating worldview is therefore valuable in illuminating the social and cultural context and dispositions inherent within the lived experience of self-repairers' personhood. This is because it functions as an embedded system of meaning and meaning making that helps self-repairers interpret and make sense of the world around them, and to narrate this through their lived experiences of self-repair and its spillover.

4.2 Operationalising the Integrated Framework

The dialectic approach inherent to this integrated theoretical framework strongly signals the need for qualitative phenomenological research to build rich and deep insight, in-line with the illustrative research themes in table 1. This is because phenomenology is concerned with the co-constitution of human existence in the world as world relationships. This entails the existence of people living and engaging in and experiencing the world (Ponty, 1942). In so doing, it enables the uncovering of alternative ways of understanding behaviours, such as self-repair to extend product lifetimes. Accordingly, phenomenological interviewing involves the description of phenomenon – as life-worlds – and not explanation or the identification of data relationships (Husserl, 2000; Merleau Ponty, 1942; Thompson *et al.,* 1989). This emphasis on life-worlds renders phenomenology well suited to exploring integrated worldview *and* personhood because it facilitates building deep understanding of self-repairers as persons, their socially and culturally determined worldview, the meanings they ascribe to self-repair, and their waste prevention and spillover behaviours within their life-world. Thus, phenomenology facilitates dialectical free-flow of the life-world descriptive narratives of our self-repair participants (Thompson, 1997; Thompson *et al.,* 1989). Alternate narrations are suggested in table 1.

4.3 The Research Contribution of the Framework

This integrated framework expedites a critical element of researching self-repair, which is the facilitation of self-repairers to be reflexive as they 'speak for themselves' about their thoughts and evaluation of their self-repair and spillover life experiences, including 'contradictory' consumption, product lifetimes, sustainable consumption and waste prevention choices. This is because this framework enables self-repairers to articulate their 'inside-out' (internal

schema) and 'outside-in' (external social systems) self-repair and spillover narratives. This more dialectical perspective facilitates the revelation of a deeper dynamic interplay between the worldview-personhood identities of self-repairers within which their behaviour takes place. Accordingly, it stimulates a myriad of narratives on future research themes on self-repairers 'ways of knowing, being and behaviour'. Table 1 presents examples of these themes, premised on the five elements of worldview with social, objective and subjective personhood.

Insert table 1 about here.

Overall, this integrated framework significantly contributes to the development of cutting-edge theorisation of self-repairers. It connects the sociocultural world of consumers to behaviour change, policy-making and product design interventions in the complex transitioning nexus of obsolescence and consumerism and product lifetimes, waste prevention and environmental sustainability.

5. Conclusion

We have critically evaluated the current state of consumer evidence on self-repairers and product lifetimes to identify the problematic issues emerging in this field. The limited theorisation of self-repairers emerging from this evidence review is challenging because increasing understanding of them is important to advancing the acceptance and implementation of extended product lifetimes within a circular economy. Studying these unconventional consumers can significantly contribute to deeper comprehension of the psychology underlying the social organisation of their less wasteful and curtailed consumption lifestyles.

The integrated worldview-personhood theoretical framework aids those researchers intent on generating exhaustive insight into self-repairers, product lifetimes, and their spillover

behaviours, and other unusual consumer groups in connected fields. It can reduce the knowledge-gaps on self-repairers integrated worldview-personhood to enrich comprehension of why this transformational engagement with product lifetimes, sustainability and waste prevention behaviours occurs. Its capacity to embrace inside out, outside-in interactions is a major advantage for exploring complicated behavioural problems. This is because it encourages self-repairers 'voice' as they navigate and analyse their internal thinking and the social systems influencing their behavioural choices. Messiness and contradiction are inherent elements of this human reflexivity, and thus absorbed by the intellectual constructs within the framework, in ways that deterministic studies cannot achieve. A phenomenological research approach bolsters this dialectical strength of the framework. The underlying attributes of personhood and worldview also suggest self-repairers and potentially other unorthodox consumers could become a 'catalyst of change', by acting as *'warriors', 'champions', 'revolutionaries',* analytically collaborating with consumers, producers, designers and policy-makers to progress a societal cultural shift to a circular economic model for ecological and societal good.

Finally, we recommend researchers should widen their research scope to explore potential avant-garde behaviour change agents who can contribute to this shift. They should avoid being locked into a voluntarist and deterministic research disposition, which will constrain their criticality and research reflexivity on what, how and why such unusual sustainability and waste prevention behaviours occur. Considering how such unconventional behaviours could be translated into consumption practices and product design for mainstream consumer adoption would also be a promising avenue of research enquiry.

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Figure 1: The Integrated Personhood and Worldviews Conceptual Framework

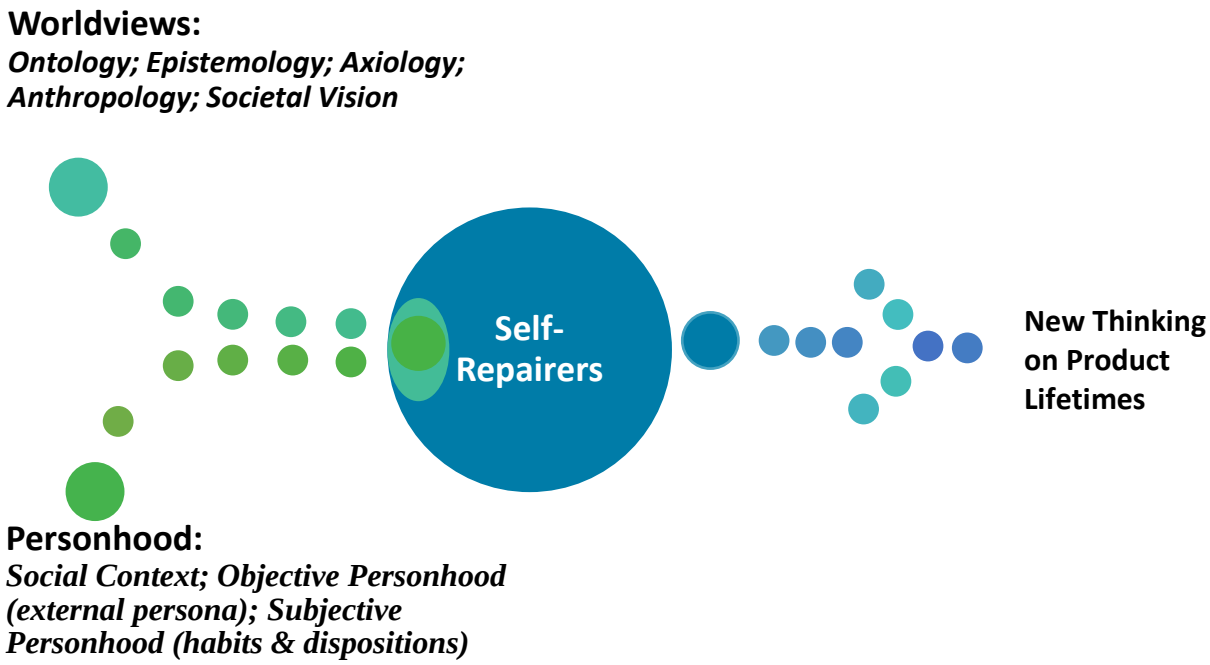

Table 1: Research Themes to Explore Worldview-Personhood of Self-Repairers

Research Themes:
What does it mean to be a consumer in contemporary society, and why? *What societal and cultural forces are at play (obsolescence (throwaway), consumerism and product lifetimes)? Do they accept or resist? How?* *How would they narrate their life-world as a consumer?*
What does it 'mean' to be a self-repairer in the modern world, and why? *What societal and cultural forces are at play? Do they accept or resist?* *What is the worldview-personhood of a self-repairer?*
How would they narrate their life-world as a self-repairer? For example: *'Ecological-warrior' activism intent on changing corporate and consumer behaviour? How & why?* *Waste prevention champions with moral/fairness/justice values underpinning their personhood? How & why?* *A 'revolutionary' worldview-personhood challenging the perceived intransigence of manufacturers (and government) and the 'throwaway society'? How & why?* *Perceptive 'savvy consumers' whose worldview-personhood represents a consumerist, market-driven orientation as they effectively manoeuvre within the marketplace? How & why?*
Are other types of 'should self' persona more applicable to self-repairers worldview-personhood, e.g., 'waste watchers', ethical consumer, global citizen, and anti-consumption/ frugality/curtailment; and which social systems connect their personas? How & why?
Can self-repair be considered an exemplar of waste prevention behaviours? Or of sustainable consumption curtailment behaviours? Does it trigger spillover or rebound effects? How & why?
Is their worldview-personhood the 'keeper of memories' residing within their psychological ownership and attachment to their treasured (repaired) possessions? What happens to the symbolic product repositories of these memories when their lives can no longer be extended by repair? How & why?
Are certain types of possessions inherent to the identity-meanings of self-repairers worldview-personhood and thus 'worthy' of repairing? How & why? Are some memorable possessions rejected as 'unworthy' of repairing, and why?
Is their worldview-personhood an 'ambassador of the future' waiting for the technological revolution of 'personal manufacturing' (e.g. 3D printing) and 'smart circular manufacturing' to normalise repair to extend product lifetimes and product design for longevity? How & why?

Theorising self-repairers' worldview-personhood to advance new thinking on extended product lifetimes

Supplementary Document: Data set and descriptive analysis (online only)

Content

Table 2: Data and Classification (n=183)

				Coding	
Theoretical Orientation	**Methodological Orientation**	**Behaviour**	**Studies**	**Meth.**	**Beh.**
Attitudes and behaviour *(n=50)*	4) Survey(s) 5) Interviews 8) Meta-analysis 12) Multi-method 13) Field study	a) Conservation (nature/ecology) b) Ethical consumption d) Pro-environmental behaviour e) Recycling g) Sustainable consumption h) Waste reduction & prevention j) Remanufactured products k) Environmental activism	Aguilar-Luzon *et al.* (2012)	*4*	*e*
			Bamberg (2003)	*4*	*d*
			Barr (2007)	*4*	*h*
			Bortoleto (2016)	*4*	*h*
			Bortoleto *et al.* (2012)	*4*	*h*
			Bovea *et al*. (2016)	*4*	*h*
			Carfora *et al.* (2017)	*4*	*d*
			Carrington *et al.* (2014)	*5*	*b*
			Chan & Bishop (2013)	*4*	*e*
			Claudy *et al. (2013)*	*4*	*d*
			Cleveland *et al.* (2012)	*4*	*d*
			Davies *et al.* (2002)	*8*	*e*
			Darby & Obara (2005)	*12*	*h*
			De Maya *et al.* (2011)	*4*	*g*
			Ertz *et al*. (2016)	*4*	*g*
			Echegaray & Hansstein (2017)	*4*	*h*
			Fielding *et al.* (2008)	*4*	*k*
			Ha & Janda (2012)	*4*	*h*

			Hawcroft & Milfont (2010)	*8*	*d*
			Kaiser *et al.* (2005)	*4*	*a*
			Kaiser *et al.* (1999)	*4*	*d*
			Khor & Hazen (2016)	*4*	*j*
			Kim & Choi (2005)	*4*	*g*
			Kumar *et al.* (2017)	*4*	*g*
			Leonidou *et al.* (2010)	*4*	*g*
			Liobikienė *et al.* (2016)	*4*	*g*
			Lizin *et al*. (2017)	*4*	*e*
			Mancha & Yoder (2015)	*4*	*d*
			Lynn (2014)	*4*	*d*
			Mannetti *et al*. (2004)	*4*	*e*
			Nigbur *et al*. (2010)	*13*	*e*
			Nguyen *et al.* (2017)	*4*	*g*
			Oreg & Katz-Gerro (2006)	*4*	*d*
			Park & Ha (2014)	*4*	*e*
			Paul *et al.*(2016)	*4*	*g*
			Pérez-Belis *et al*. (2017)	*4*	*h*
			Polonsky *et al*. (2012)	*4*	*d*
			Shaw *et al.* (2016)	*5*	*b*
			Shi *et al.* (2017)	*4*	*h*
			Sidique *et al*. (2010)	*4*	*e*
			Tan *et al.* (2017)	*4*	*h*

			Tang *et al.* (2011)	*4*	*e*
			Taufique & Vaithianathan (2018)	*4*	*g*
			Tonglet *et al.* (2004)	*14*	*e*
			Tucker & Izadpanahi (2017)	*4*	*d*
			Verma & Chandra (2018)	*4*	*d*
			Vermeir & Verbeke (2008)	*4*	*g*
			Webb & Sheeran (2006)	*8*	*d*
			Yadav & Pathak (2016)	*4*	*g*
			Yazdanpanah & Forouzani (2015)	*4*	*g*
Awareness, knowledge & pro-environmental consciousness *(n=10)*	1) Conceptual 3) Experiment 4) Survey(s)	d) Pro-environmental behaviour g) Sustainable consumption j) Remanufactured products	Bittar (2018)	*3*	*j*
			Hazen *et al.* (2012)	*4*	*j*
			Koenig-Lewis *et al.* (2014)	*4*	*d*
			Kollmuss & Agyeman (2002)	*1*	*d*
			Leire & Thidel (2005)	*1*	*g*
			Michaud & Llerena (2011)	*3*	*j*
			Taufique *et al.* (2017)	*4*	*g*
			Vicente-Molina *et al.* (2013)	*4*	*d*
			Wang & Hazen (2016)	*3*	*j*
			Zsóka *et al.* (2013)	*4*	*d*
Values: *(n=25)* *Pro-environmental/ethical/moral* *Altruistic/biospheric/egoistic*	1) Conceptual 3) Experiment 4) Survey(s)	d) Pro-environmental behaviour	Chan (2001)	*4*	*g*
			Chan *et al.* (2006)	*4*	*g*
			de Groot & Steg (2008)	*4*	*d*

Hedonic/materialistic/symbolic *Cultural values*	5) Interviews 8) Meta-analysis 12) Multi-method	g) Sustainable consumption i) Consumption reduction	Gatersleben *et al.* (2014)	*4*	*d*
			Gatersleben *et al.* (2010)	*4*	*d*
			Griskevicius *et al.* (2010)	*3*	*g*
			Hao (2014)	*4*	*d*
			Haws *et al.* (2014)	*12*	*g*
			Howell (2013)	*5*	*d*
			Hurst *et al.* (2013)	*8*	*d*
			Kilbourne & Pickett (2008)	*4*	*d*
			Kilbourne *et al.* (2005)	*4*	*g*
			Lin & Huang (2012)	*4*	*g*
			Martin & Czellar (2017)	*12*	*d*
			Noppers *et al.* (2014)	*4*	*d*
			Pepper *et al.* (2009)	*4*	*i*
			Podoshen *et al.* (2011)	*4*	*g*
			Polonsky *et al.* (2014)	*4*	*d*
			Soyez (2012)	*4*	*d*
			Sreen *et al.* (2018)	*4*	*g*
			Steg *et al.* (2014)	*4*	*d*
			Stern (2000)	*1*	*d*
			Sun *et al.* (2016)	*4*	*g*
			van der Werff & Steg (2016)	*4*	*d*
			van der Werff *et al.* (2013b)	*4*	*d*
Cultural orientation *(n=6)*	4) Survey(s) 7) Mixed methods	a) Conservation (nature/ecology)	Cho *et al.* (2013)	*4*	*g*
			Cruz-Cárdenas *et al.* (2016)	*7*	*h*

		d) Pro-environmental behaviour g) Sustainable consumption h) Waste reduction & prevention	Kovácsa *et al.* (2014)	*4*	*d*
			Price *et al.* (2014)	*4*	*a*
			Strizhakova & Coulter (2013)	*4*	*g*
			Sudbury Riley *et al.* (2012)	*4*	*d*
Environmental concern *(n=14)*	1) Conceptual 3) Experiment 4) Survey(s)	a) Conservation (nature/ecology) d) Pro-environmental behaviour e) Recycling g) Sustainable consumption	Best & Mayerl (2013)	*4*	e
			Casaló & Escario (2016)	*4*	*d*
			Dunlap & Jones (2002)	*1*	*d*
			Hartmann & Apaolaza-Ibáñez (2012)	*3*	*d*
			Hirsch (2010)	*4*	*d*
			Leary *et al.* (2014)	*4*	g
			Lee *et al.* (2014)	*4*	*d*
			Meeusen (2014)	*4*	d
			Rhead (2015)	*4*	*d*
			Schaffrin (2011)	*1*	*d*
			Schultz (2001)	*4*	*d*
			Schultz *et al.* (2005)	*4*	*a*
			Sulemana *et al.* (2016)	*4*	*d*
			Xiao *et al.* (2013)	*4*	*d*
Identity & Personhood *(n=13)*	4) Survey(s) 5) Interviews 9) Phenomenology 11) Discourse/Narrative 12) Multi-method	a) Conservation (nature/ecology) b) Ethical consumption d) Pro-environmental behaviour	Arnocky *et al*. (2007)	*4*	*d*
			Armstrong *et al.* (2018)	*14*	*g*
			Autio *et al*. (2009)	*11*	*g*
			Brick *et al.* (2017)	*4*	*d*
			Cherrier (2012)	*9*	*g*
			Dermody *et al.* (2015)	*4*	*g*

		g) Sustainable consumption	Dermody *et al.* (2018)	*4*	*g*
			Kashima *et al*. (2014)	*4*	*a*
			Moisander & Pesonen (2002)	*11*	*d*
			Shaw & Shiu (2002)	*4*	*b*
			van der Werff *et al.* (2013a)	*12*	*d*
			van der Werff *et al.* (2014)	*4*	*d*
			Varul (2009)	*5*	*b*
			Whitmarsh & O'Neill (2010)	*4*	*d*
Obsolescence, product lifetimes & material culture *(n=19)*	2) Ethnography 3) Experiment 4) Survey(s) 5) Interviews 10) Discussion groups 12) Multi-method 13) Field study	c) Pre-owned f) Repair g) Sustainable consumption h) Waste reduction & prevention m) Discarding	Baxter *et al.* (2015)	*5*	*h*
			Keiller & Charter (2014)	*4*	*f*
			Keiller & Charter (2015)	*4*	*f*
			Cole and Gnanapragasam (2017)	*13*	*f*
			Cooper (2004)	*12*	*m*
			Cooper (2005)	*12*	*g*
			Cox *et al*. (2013)	*10*	*h*
			Echegaray (2016)	*4*	*m*
			Evans & Cooper (2010)	*12*	*h*
			Fortuna & Diyamandoglu, (2017)	*4*	*c*
			Gnanapragasam & Cole (2017)	*13*	*f*
			Gregson *et al*. (2009)	*2*	*f*
			Hennies & Stamminger (2016)	*4*	*m*
			Lilley *et al.* (2013)	*12*	*f*

			Marchand *et al.* (2010)	*12*	*g*
			Mashhadi *et al.* (2016)	*4*	*f*
			Salvia *et al.* (2015)	*4*	*f*
			Sun & Trudel (2017)	*3*	*h*
			Van Nes & Cramer (2006)	*14*	*g*
Alternative sustainability/ consumption/waste discourses *(n=17)*	1) Conceptual 3) Ethnography 4) Survey(s) 5) Interviews 12) Multi-method	f) Repair g) Sustainable consumption h) Waste reduction & prevention l) Anti-consumption	Assadourian (2010)	*1*	*g*
			Berkin *et al.* (2006)	*3*	*h*
			Black & Cherrier (2010)	*5*	*l*
			Chatzidakis & Lee (2013)	*1*	*l*
			Cherrier et al. (2011)	*5*	*l*
			de Coverly *et al.* (2008)	*12*	*h*
			Dolan (2002)	*1*	*g*
			García-de-Frutos *et al.* (2018)	*1*	*l*
			Graham & Thrift (2007)	*1*	*f*
			Hutter & Hoffmann (2013)	*4*	*g*
			Moisander (2007)	*1*	*g*
			Prothero *et al.* (2010)	*1*	*g*
			Prothero & Fitchett (2000)	*1*	*g*
			Mittelstaedt *et al.* (2014)	*1*	*g*
			Moraes *et al.* (2010)	*3*	*g*
			Soper (2007)	*1*	*l*
			Zavestoski (2002)	*5*	*l*
Norms and Infrastructure: (*n=21)* *Societal and economic norms and infrastructure*	3) Experiment 4) Survey(s)	d) Pro-environmental behaviour	Abbot *et al*. (2013)	*14*	*e*
			Bamberg *et al.* (2007)	*4*	*d*

Social ties, social and personal norms	6) Mathematical modelling 12) Multi-method 14) Secondary data	e) Recycling f) Repair g) Sustainable consumption h) Waste reduction & prevention i) Consumption reduction	Brekke *et al*. (2010)	*14*	*e*
			Cecere *et al.* (2014)	*4*	*h*
			Czajkowski *et al*. (2014)	*3*	*h*
			Goldstein *et al.* (2008)	*4*	*i*
			Hage *et al*. (2009)	*4*	*e*
			Hage & Söderholm (2008)	*14*	*h*
			Harland *et al.* (2007)	*12*	*d*
			Kormos *et al.* (2015)	*3*	*d*
			Matsueda & Nagase (2012)	*6*	*d*
			Matsueda & Nagase (2008)	*6*	*d*
			McCollough (2009)	*14*	*f*
			Milford *et al.* (2015)	*3*	*e*
			Onwezen *et al.* (2013)	*4*	*d*
			Schultz *et al.* (2007)	*3*	*i*
			Steg *et al.* (2011)	*4*	*d*
			Sussman *et al.* (2013)	*3*	*h*
			Thøgersen (2006)	*4*	*d*
			Thøgersen (2009)	*4*	*g*
			Viscusi *et al.* (2011)	*14*	*e*
Worldviews *(n=7)*	1) Conceptual 4) Survey(s) 5) Interviews	a) Conservation (nature/ecology) d) Pro-environmental behaviour	Connolly & Prothero (2003)	*9*	*g*
			Connolly & Prothero (2008)	*5*	*g*

	8) Meta-analysis 9) Phenomenology	g) Sustainable consumption	De Vries & Peterson (2009)	*1*	*d*
			Hedlund-de Witt (2012)	*8*	*d*
			Hedlund-de Witt (2013)	*4*	*g*
			Hedlund-de Witt *et al.* (2014)	*4*	*d*
			Koltko-Rivera (2004)	*1*	*a*

Figures 2a-e: Descriptive Analysis

Figure 2a: Range of Theoretical Orientations

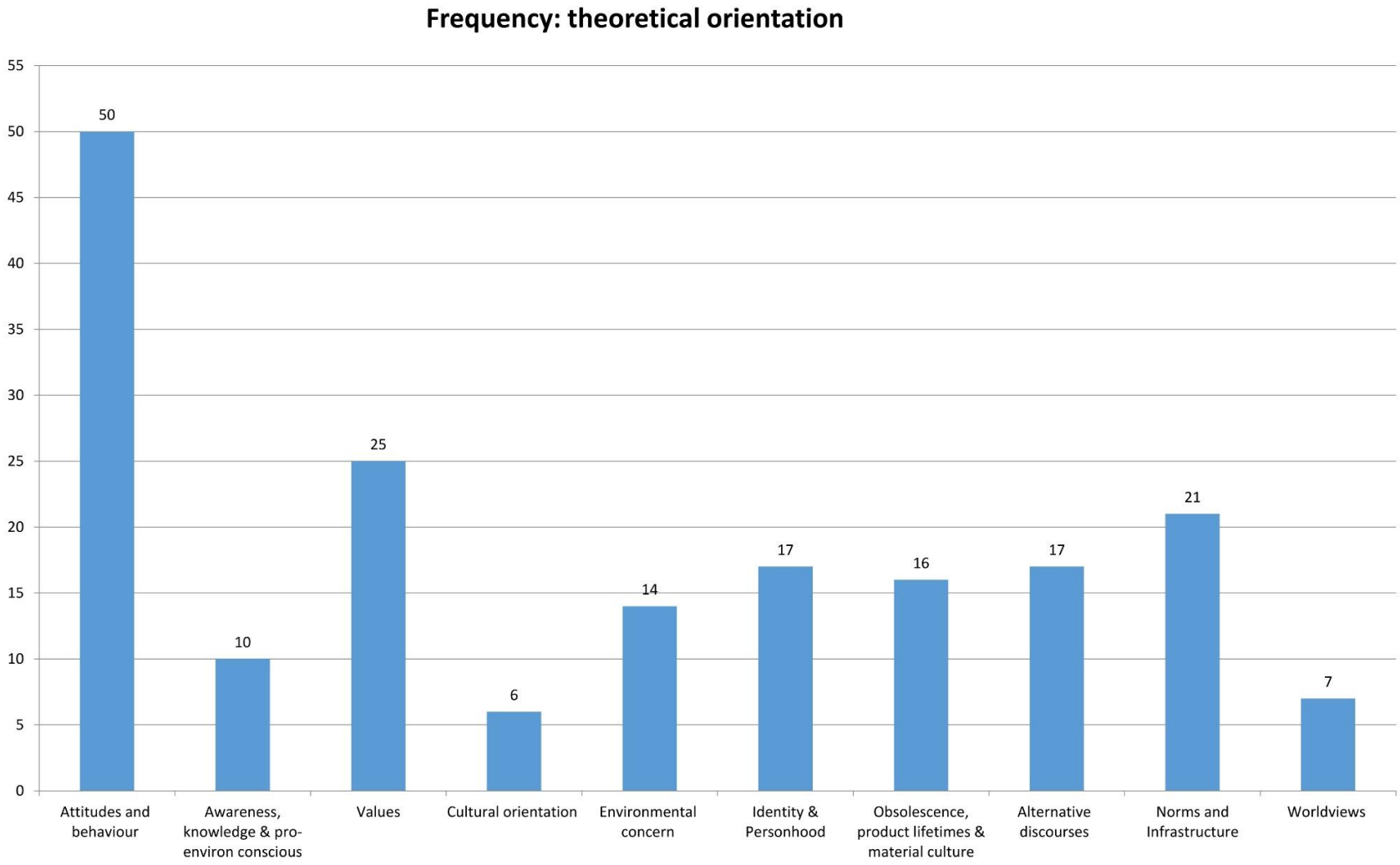

Figure 2b: Range of Methodologies

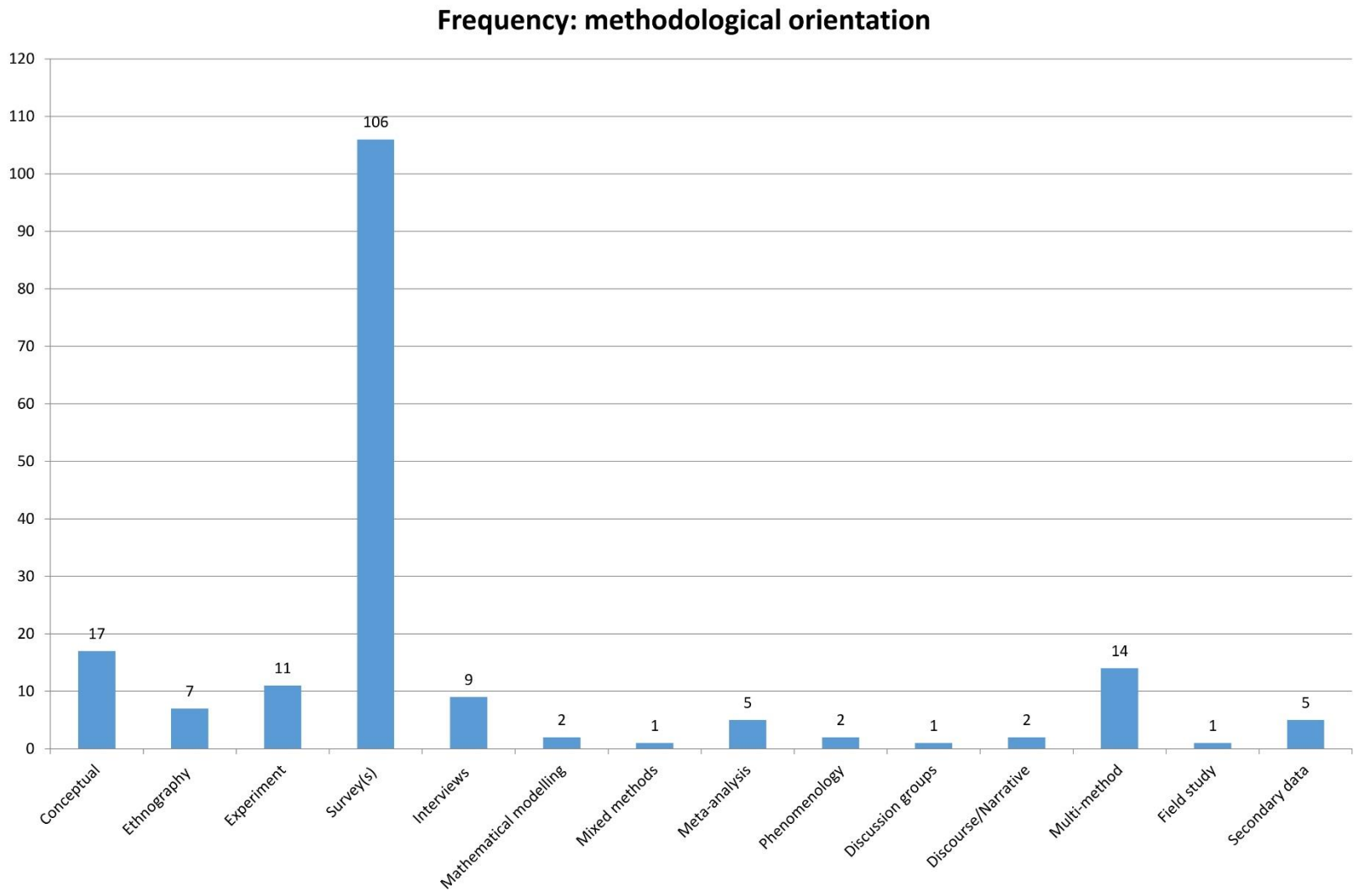

Figure 2c: Range of Environmental Behaviours

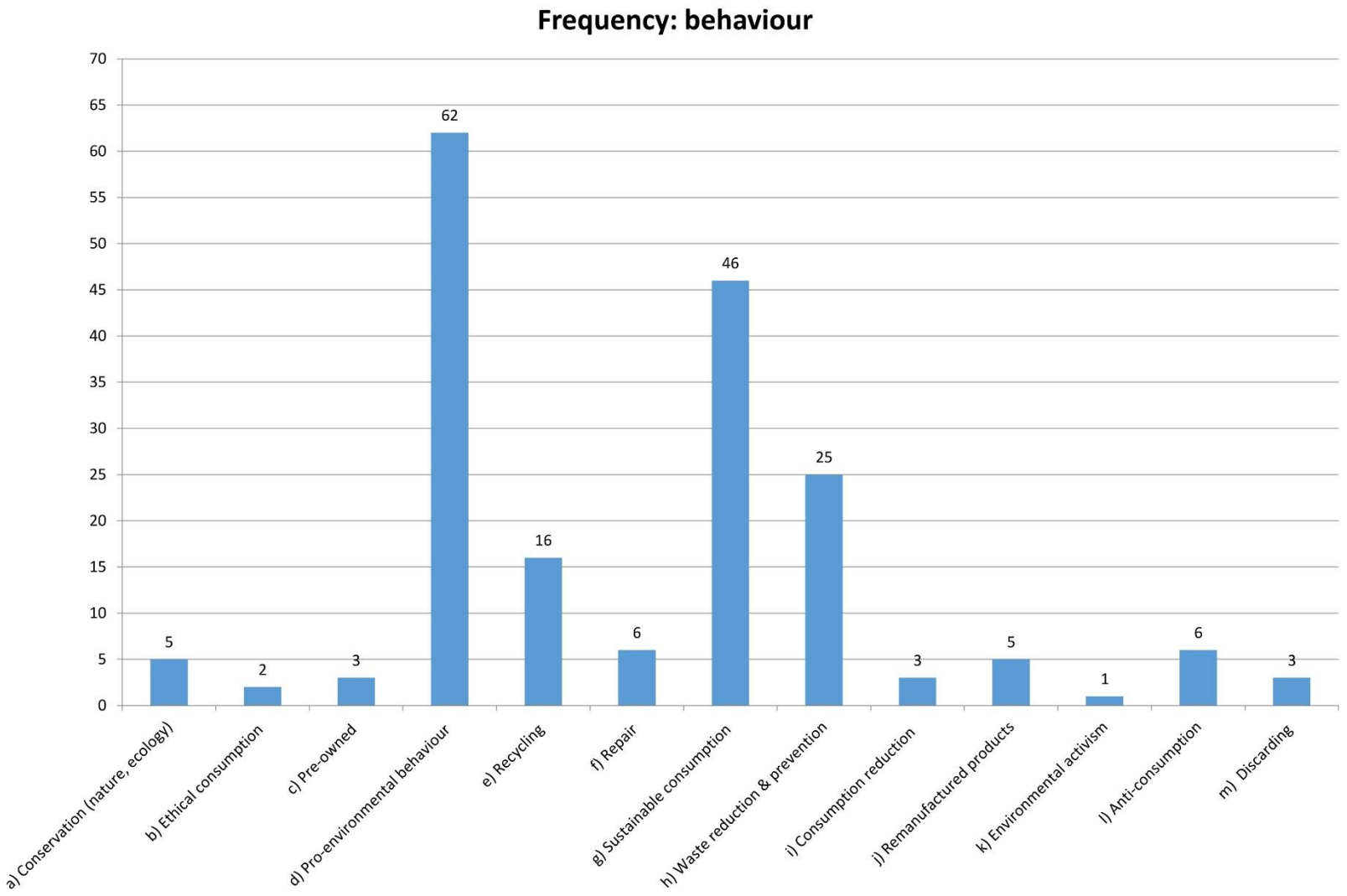

Figure 2d: Frequency of Methodologies by Theoretical Orientation

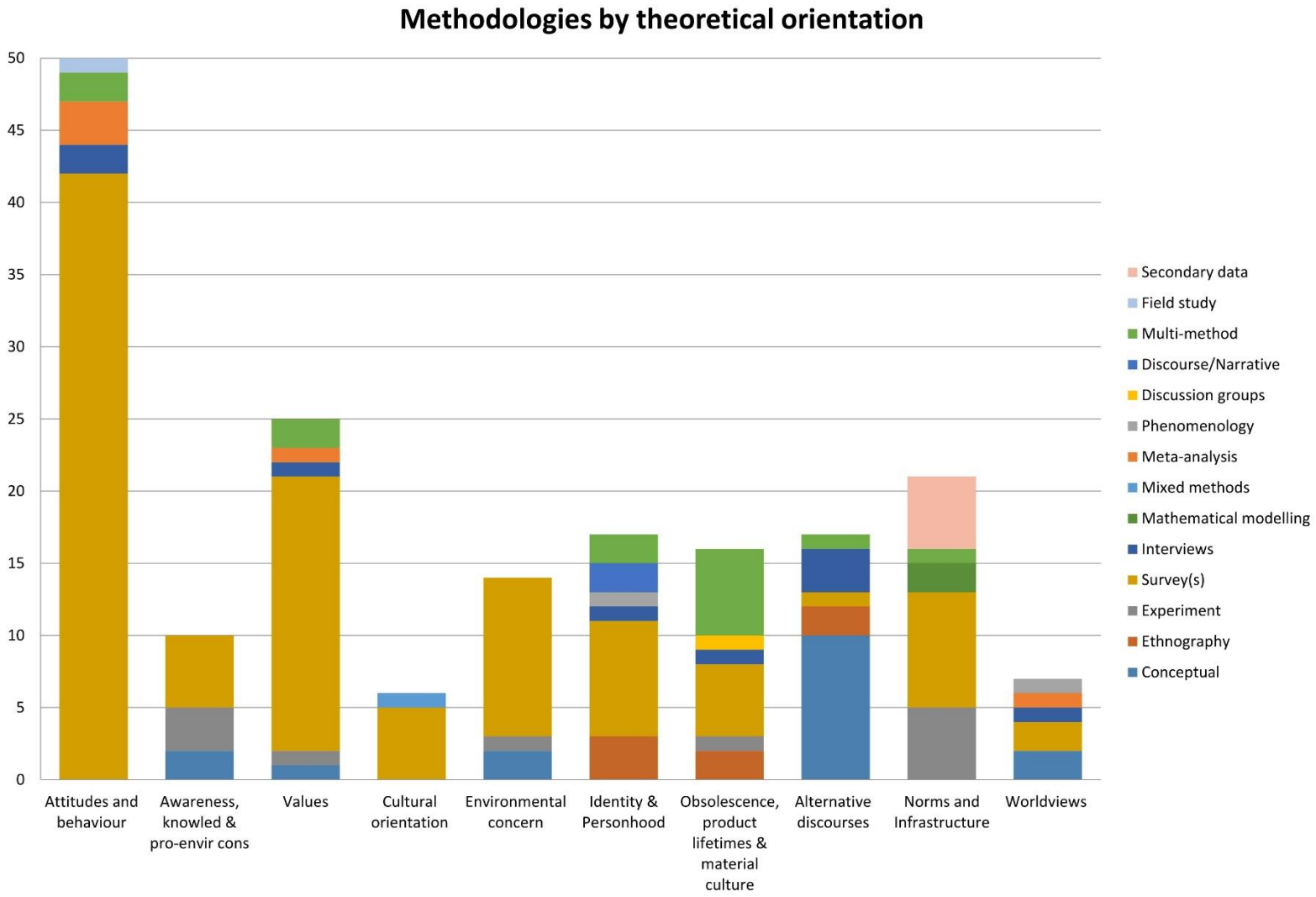

Table 3: Supporting Frequency Data (for figure 2d)

															Legend
Theoretical Orientation	**Methodologies**														[1] Conceptual
	[1]	**[2]**	**[3]**	**[4]**	**[5]**	**[6]**	**[7]**	**[8]**	**[9]**	**[10]**	**[11]**	**[12]**	**[13]**	**[14]**	[2] Ethnography
Attitudes and behaviour *(n=50)*	0	0	0	**42**	**2**	0	0	**3**	0	0	0	**2**	**1**	0	[3] Experiments
Awareness, knowledge & pro-environmental consciousness *(n=10)*	**2**	0	**3**	**5**	0	0	0	0	0	0	0	0	0	0	[4] Survey(s)
Values *(n=25)*	**1**	0	**1**	**19**	**1**	0	0	**1**	0	0	0	**2**	0	0	[5] Interviews
Cultural orientation *(n=6)*	0	0	0	**5**	0	0	**1**	0	0	0	0	0	0	0	[6] Math-modelling
Environmental concern *(n=14)*	**2**	0	1	**11**	0	0	0	0	0	0	0	0	0	0	[7] Mixed-method
Identity & Personhood *(n=13)*	0	**3**	0	**8**	**1**	0	0	0	**1**	0	**2**	**2**	0	0	[8] Meta-analysis
Obsolescence, product lifetimes & material culture *(n=19)*	0	**2**	**1**	**5**	**1**	0	0	0	0	**1**	0	**6**	0	0	[9] Phenomenology
Alternative discourses *(n=17)*	**10**	**2**	0	**1**	**3**	0	0	0	0	0	0	**1**	0	0	[10] Discussion
Norms and Infrastructure: (*n=21)*	0	0	**5**	**8**	0	**2**	0	0	0	0	0	**1**	0	**5**	[11] Narrative
Worldviews *(n=7)*	**2**	0	0	**2**	**1**	0	0	**1**	**1**	0	0	0	0	0	[12] Multi-method
															[13] Field study
Total	**17**	**7**	**11**	**106**	**9**	**2**	**1**	**5**	**2**	**1**	**2**	**14**	**1**	**5**	[14] Secondary

Figure 2e: Frequency of Behaviours by Theoretical Orientation

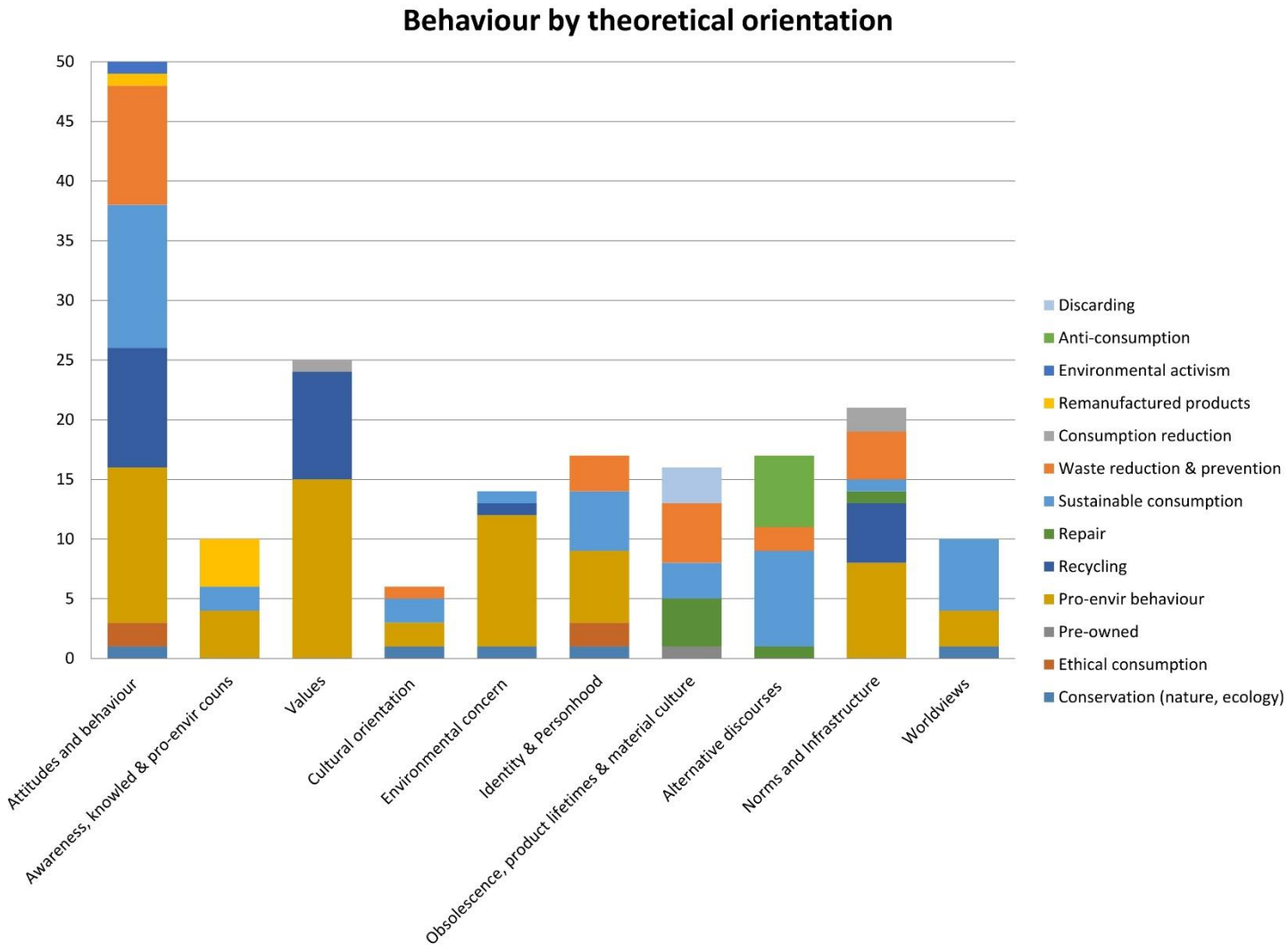

Table 4: Supporting Frequency Data (for figure 2e)

Theoretical Orientation	Behaviours													Legend
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[1] Conservation
Attitudes and behaviour *(n=50)*	**1**	**2**	0	**13**	**10**	0	**12**	**10**	0	**1**	**1**	0	0	[2] Ethical
Awareness, knowledge & pro-environmental consciousness *(n=10)*	0	0	0	**4**	0	0	**2**	0	0	**4**	0	0	0	[3] Pre-owned
Values *(n=25)*	0	0	0	**15**	**9**	0	0	0	**1**	0	0	0	0	[4] Pro-environmental
Cultural orientation *(n=6)*	**1**	0	0	**2**		0	**2**	**1**	0	0	0	0	0	[5] Recycling
Environmental concern *(n=14)*	**1**	0	0	**11**	**1**	0	**1**	0	0	0	0	0	0	[6] Repair
Identity & Personhood *(n=13)*	**1**	**2**	0	**6**	0	0	**5**	**3**	0	0	0	0	0	[7] Sustainable Consumpt.
Obsolescence, product lifetimes & material culture *(n=19)*	0	0	**1**	0	0	**4**	**3**	**5**	0	0	0	0	**3**	[8] Waste reduction
Alternative discourses *(n=17)*	0	0	0	0	0	**1**	**8**	**2**	0	0	0	**6**	0	[9] Consumption Reduction
Norms and Infrastructure: (*n=21)*	0	0	0	**8**	**5**	**1**	**1**	**4**	**2**	0	0	0	0	[10] Remanufactured
Worldviews *(n=7)*	**1**	0	0	**3**	0	0	**6**	0	0	0	0	0	0	[11] Activism
														[12] Anti-consumption
Total	**5**	**4**	**1**	**62**	**25**	**6**	**40**	**25**	**3**	**5**	**1**	**6**	**3**	[13] Discarding

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