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Introduction

The papers presented in this publication are drawn from the Faculty of Technology, Design and Environment's Annual Research Student Conference held in May 2019. The Conference is a key part of our Faculty Doctoral Training Programme (DTP) which provides on-going support and training for research students throughout their time at Brookes.

The contributions highlight the excellent and varied research being carried out by our students across a range of disciplines including - Architecture, Art, Built Environment, Computing and Engineering. In addition the conference and this publication were brought together by an enthusiastic and talented group of research students. This underlines not only the range of their skills but also our commitment to ensuring students gain the necessary experience to develop their future research careers.

This publication both celebrates the work and the research skills of our students and brings them to the attention of the wider audience they deserve. As Chair of the DTP I would also like to highlight how the conference and this publication demonstrate the Faculty's ongoing commitment to ensuring students studying at Brookes achieve their full potential as researchers.

Thanks to all who have contributed to make the conference and this publication such a success and I look forward to future editions.

Dr. Sue Brownill
Chair of the Doctoral Training Programme

Content

Integrated Urban Streets Design in Mid-size Chinese Cities: The case of Lishui

Longwei Chen

Abstract

Streets can be described as “life between buildings” in the urban areas, they are regarded as the structure or skeleton of a city. They are a symbol of the identity of a city and the basic elements of its landscape. This research focus on urban street design in mid-size Chinese Cities: the case of Lishui. The following methods were used for the data collection during the field: typo-morphological data collection, field observation method and interviews. To investigated typology of streets and the ways in which we can accommodate different social cultural function of streets in modern Chinese society. And also, to investigate by linking theoretical concepts and street design practice as both the movement corridors and places that address the social role and cultural characteristics of the streets. As the results, this research proposes to develop theoretical and urban design principles of streets design, both as a global phenomenon and a locally responsive solution; in the context of Chinese, medium and small cities, to meet current and future needs in terms of quality of streets.

Key words: urban street design, typo-morphological, field observation, interviews, social cultural, modern Chinese society, urban design principles, quality of streets.

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His doctoral research, conducted under the supervision of Prof. Georgia Butina Watson and Dr. Laura Novo de Azevedo, explores key urban design principles that could contribute to the qualities of streets in the context of China’s medium size cities, particularly aiming at designing culturally specific urban streets.

1. Introduction

Leonard and Egan (2014) define streets as the areas with rights-of-way and ease of use built to move people and vehicles in cities. However, streets not only simply provide the infrastructure for vehicle movement, they also contribute in many ways to the economic, environmental and social functions of cities (Jones and Boujenko, 2009). In other words, streets can be described as "life between building" (Gehl, 2010). Mehta (2009), Abramson (2008), Wang (2012), Adams (2013), Chen and Thwaites (2013) state that in the urban areas, streets are regarded as the structure or skeleton of a city, representing around 80% of public realm and they are a symbol of the identity of a city and the basic elements of its landscape. A well-designed city should be noted for the quality of its streets, as most urban activity and much urban identity are closely associated with the urban street network and have a strong impact on the image of an area (Jones and Boujenko, 2009; Fachrudin and Ali, 2012).

During the last century, many cities have focused on improving urban infrastructure to accommodate car travel; this is especially evident after the 1960s when there was an increasing number of cars on the streets (Gehl and Svarre, 2013). As a result, the traditional street was transformed from a socially meaningful space that was central to people's lives, to a space used merely for the movement of vehicles (Mehta, 2013). In addition, dominant planning ideologies – modernism in particular – have specially put a low priority on the role of streets as a meeting place (Gehl, 2010). Therefore, it was not only the increase in the number of cars that posed a challenge to street life; modernism, as a planning ideology, has also gradually shifted from the low, dense traditional street patterns with rich social urban functions, to wider road lay-outs and higher tower blocks buildings, and functional zoning principles (Carmona et al, 2010). As a consequence, the human scale of traditional streets was lost and radically altered (Gehl and Svarre, 2013).

In China, traditional urban design and street networks were strictly controlled by the feudal monarchy (Jin, 1993). The function of streets was political, military and ritual (Chen and Thwaites, 2013). Until the Song dynasty (960-1279), the human scale of streets promoted social interaction; streets were vibrant places for human daily life with mixed use; there were restaurants, brothels, tea-houses, private residences, temples and medicine shops (Xie, 2012). However, since industrialisation and economic growth in the 1990s (Shirgaokar et al., 2013), China has increasingly aspired to become more like developed nations; the traditional human dimensions and function of streets has changed, being replaced by modern, engineered roads and large, poorly defined, open spaces.

2. Urban Streets Issues in Medium and Small Cities in China

With the rapid economic development and urbanisation process in China, the contemporary streets in medium or small cities lack urban qualities (Cheng et al., 2007; Whitehand and Gu, 2006).

First, as a consequence, there is a conflict between public space in traditional streets and roads in modern Chinese cities. The new street design in Chinese cities focuses primarily on having wider roads and priority is given to motor vehicles (Cheng et al., 2007; Abramson, 2008). As a result, the sidewalks remain narrow, the streets have lost their intimate scale and transparency, and are devoid of public life (Miao, 2011; Forsyth and Southworth, 2008).

Second, as a result of adopting modernist urban planning principles, large superblocks have decreased visual permeability and diversity; the larger the block, the more difficult it is to see from one junction to the next (Carmona et al., 2010; Bauer, 2013; Yu; 2014). Moreover, the rectilinear layout of streets disregards topography and any other natural features of the land, resulting in the loss of physical, social and cultural characteristics of the city (Mehta, 2013). The modernist planning ideology is also manifested as the loss of cultural identity of Chinese streets (Shirgaokar et al., 2013).

3. Research Question, Aim and Objectives

The key research question:

» What are the key urban design principles that contribute to the qualities of streets in the context of China's medium size cities – with reference to Lishui?

The overall aim of this research:

» To develop a body of theory and urban design principles for culturally specific urban streets, in medium size Chinese towns – the case of Lishui.

In order to address this aim, the following objectives have to be achieved in this study:

» Objective one: to develop a conceptual framework for analysing urban design qualities of Chinese Streets.

» Objective two: to use the conceptual framework to develop a methodology to analyse streets in medium size Chinese cities.

» Objective three: to use the conceptual framework and methodology to collect data and to analyse different street patterns and their qualities in China – Lishui

» Objective four: to use the findings and propose new theoretical concepts and urban design principles for culturally specific street design in the context of Lishui, China.

» Objective five: to test the proposals with key stakeholders (planners, engineers and residents).

» Objective six: to develop a novel theoretical and urban design approach to designing streets in Chinese cities.

4. Research Methods

1.1. Typo-morphological data collection

Typo-morphological data analysis will be divided into three categories. First, the overall spatial structures of the city will be analysed: this includes the form and transformation of the urban landscape from the past to modern times; the changing characteristics of urban street networks in Lishui. Second, there will be an overview of the spatial structure of two sub-case studies (one historical and one newly developed): this will include identifying and analysing urban block structures, plots/uses of the blocks and land and building use in both sub-case studies; and analysis of street layout, connectives and characteristics.

The following data will be collected during the fieldwork for the typo-morphological analysis: Government documents and existing policies, archival maps (contemporary and historical maps), and images (of buildings, places). They will be collected from different government or institutional bodies.

1.2. Field observation method

1.2.1. Counting people, cyclists and cars on the streets:

This research will use counting tool to analyse public life studies (how many people are moving, how many people are cycling and how many cars are flowing on the street), which provides numbers for making comparisons (Gehl and Svarre, 2013) between two case studies. In order to show how streets life has been used by different groups across two sub-case studies.

1.2.2. Mapping and photographing

This research will also use mapping tool to observe and map out human activities on the streets. Three activities will be observed on the streets: standing and sitting. The total of 4 streets blocks will be identified, two streets blocks in each site. The locations of where people stay will be drawn at different times of days (ten minutes for each street block, once an hour) and for a week-long period.

To examine the interaction between public life and public space on the streets in both case studies, photographs will also be taking during the field, including buildings and public space.

1.3. Data from interviews

Semi-structured interviews of the following groups:

Government officials: they will be interviewed in order to find out information and opinions of the actors that are involved in the production and control of urban form in the city of Lishui. This allows the researcher to understand urban planning policies that influence the planning and design framework that lead to urban transformations. All the interviews will be pre-arranged and conducted in the offices of the participant. 10 people will be interviewed, each lasting approximately 45 minutes.

Professionals: information and opinions from design professionals (local and international developers, investors, university professors, planners, urban designers and architects) will be collected through semi-structured interviews. In order to gain a deeper understanding of urban streets design in the context of this case study, and also to find out their attitudes or preferences for urban street life. These semi-structured interviews will be pre-arranged and conducted in the offices of the 10 participants, each interview lasting approximately 45 minutes.

Local residents: 40 local residents (20 people for each of the case study,) ranging from 18 years of age and above, will be interviewed face-to-face, in order to find out information and opinions of their feelings, perceptions, attitudes or preferences toward the street environment and the qualities of urban street life. Additionally, photographs will also be used in the interview. Interviewees will be asked to discuss their reactions to the photographs and to consider what was being represented and how it relates to them. This will allow stimulating interviewees to engage visually with streets environments, which may help them to think in different ways (Bryman, 2016) and give a meaningful context in relation to quality of urban street design. These interviews will be conducted in their own residences or at a local café. Each interview will last approximately 30 – 45 minutes.

5. Research Gap

Recently, there has been a growing interest in researching these issues. Some researchers are interested in modern Chinese streets design, but they are mainly focusing on mega-cities or sub-provincial cities (Miao, 2011; Miao, 2003; Gaubatz, 1999, Abramson, 2008; Chen and Thwaites, 2013), such as Beijing, Shanghai, Wuhan, Hangzhou, Nanjing and so on. For

instance: Cheng et al. (2007) are interested in design of ultra-wide streets in China, which mainly focus on automobile moving. Moreover, some researchers study engineering and landscape design principles (Bai et al., 2012), focusing on large Chinese cities (Gaubatz, 1999; Miao, 2003; Miao, 2011).

However, there is a lack of research on medium or small size cities, which comprise the overwhelming majority of Chinese urban settlements (Whitehand and Gu, 2006). Large cities remain the centres of capital investment and production, but it is the small cities that have taken up a growing share of the urban population (Lin, 2002).

6. Contribution to Knowledge

There is a need to investigate typology of streets and the ways in which we can accommodate different social-cultural functions of the modern Chinese society. This will be investigated by linking theoretical concepts and street design practice as both the movement corridors and as places that address the social role and cultural characteristics of the streets.

This research proposes to develop theoretical and urban design principles of streets design, both as a global phenomenon and a locally responsive solution, in the context of Chinese medium and small cities, to meet current and future needs in terms of quality of streets.

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The Nexus of Participation and Healthy Urban Mobility in Brazil

Aline Moreira Fernandes Barata

Abstract

Brazilian cities have continued to experience increased urbanisation over recent decades coupled with a corresponding rise in ownership and use of private motorised modes of transport. Meanwhile, lack of planning and the continuation of socio-spatial inequalities has led to the marginalisation of non-motorised modes of transport, namely walking and cycling, or what has recently been described as 'healthy urban mobility'.

Public participation has been inserted into the discourse of urban sustainability plans but less has been written about the potential for citizen engagement to promote and support healthy urban mobility. This paper aims to promote a dialog between participation and healthy urban mobility, taking Brazil as the case of analysis. It explores the trajectory of discourses on healthy urban mobility within the Brazilian context through laws and current plans, highlighting its participative character, and investigates the motivations behind state-led actions, through inspecting the National Urban Mobility Policy. It concludes by highlighting the challenges and potentials for participation in promoting healthy urban mobility.

Keywords: participation, heathy urban mobility, mobility policy, social inclusion

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Her doctoral research, conducted under the supervision of Dr. Tim Jones and Dr. Sue Brownill, is entitled "Exploring the role of citizen participation in promoting equitable sustainable mobility. An investigation of spaces for participation in Brazil". Her research aims at investigating the dimensions of participation in different scenarios and exploring their potential in promoting equitable sustainable mobility through a Global South perspective.

1. Introduction

The accelerated urbanisation of Brazilian cities occurred as a consequence of two main factors: the industrial period in the 1950s and migration movements motivated by economic and social inequalities within the country. These phenomena transformed the country, which was mostly rural before the 1970s, into predominantly urban in a twenty-years span (IBGE, 2006). Spontaneous and informal urban development was the main mechanism used to occupy urban land and create housing (Fernandes, 2007), which culminated in spatial and social segregation.

The social issues resulting from the rapid urbanisation in Brazil were intensified and reproduced by state actions, as their limited response to arising spatial and social inequalities helped maintain the status quo (Voos and Cattani, 2015). One example is the insufficient attention given to urban mobility issues, usually "medicated" by public authorities through sectoral transportation measures (Izaga and Leite, 2016, p.3). In addition, the extensive use of private motorised vehicles, coupled with the "seductiveness" and infrastructure created for the car, reduced the importance of public transport and made cycling and walking less attractive (Banister, 2007, p.76).

The unsatisfactory condition of public transportation, the existing social and spatial segregation, the emergence of a participatory era with the implementation of the Federal Constitution in 1988 - after 21 years of military dictatorship -, and the development of the Statute of the City in 2001, influenced a "new type of social movement that made the call to the streets" (Caldeira, 2015, p.113). The quality and fares of public transport, traffic conditions, congestion and immobility faced in Brazil's big cities were the focus of several protests in June 2013 (Verlinghieri and Venturini, 2017).

These movements, coupled with the incorporation of mobility issues into the Federal Government agenda, represent the inclusion of urban mobility as a fundamental right in the Brazilian Constitution (Maranhão, Filho and Santos, 2017). The National Urban Mobility Policy of 2012 was the instrument used by the Federal Government to set guidelines and directions for participatory mobility plans as an "invited space for participation" (Cornwall, 2002, p.3). These invited spaces have an abstract dimension (Cornwall, 2002) which represents the channels where opportunities for citizen engagement are nourished and sanctioned by authorities in policymaking (Miraftab, 2009). Differently from "closed spaces" (Gaventa, 2005, p.12) and imposed actions with little or no public engagement, this policy reveals an entry point for citizen inclusion in urban decisions, connecting healthy urban mobility and public participation for the first time in Brazil. The "opening" for citizen participation (Brownill and Inch, 2019) represent new opportunities for contributions "outside the planning profession" (Thorpe, 2017, p.574) to engage and influence in urban mobility discussions. However, questions about the role, influences and reach of participation in healthy urban mobility debate remain.

Before moving to the next section, it is worth to briefly explain the meanings of the term "healthy urban mobility". Considering that urban mobility is understood as the possibility of moving in the city regardless the means of transportation of the individual and also as a social practice (Izaga, 2014), the term sustainable urban mobility emerges an approach that encourages any means of transportation that is less harmful to the environment (Izaga, 2014). Healthy urban mobility approach appears highlighting human-powered transport, such as walking and cycling, and examining the effects of the physical arrangements of cities on urban mobility, health and well-being (Rocha, Vargas and Silveira, 2018).

This paper aims to explore the potential for participatory channels to promote and support healthy urban mobility, through investigating the Brazilian's National Urban Mobility Policy. As a starting point, this paper investigates the way in which participation and healthy urban mobility are combined in Brazil's policymaking. As such, the analysis of the participatory discourse within the National Urban Mobility Policy will be essential to understand its challenges and potentialities.

2. The National Urban Mobility Policy

The Brazilian National Urban Mobility Policy was implemented by the Ministry of Cities through the federal law 12.857 in January 2012 as an attempt to integrate urban mobility development into city planning (Izaga and Leite, 2016, p.3) and to introduce the concept of sustainable urban mobility as one of its main characteristics. The addition of a mobility framework into the Brazilian regulations represents the inclusion of "mobility rights" (Cass, Shove and Urry, 2005, p.539). The policy covers principles and objectives in order to reduce social inequalities, promote sustainable development and improve urban accessibility and mobility (Brasil, 2012).

The policy also reinforces the transference of power from national to local authorities. This transference of power, together with the participatory premise, can also be seen in the Statute of the City of 2001 as an addition to the Federal Constitution of 1988. The participatory Master Plans – together with its revision every ten years – were considered a mandatory urban planning measure that would manage the development of all cities with over 20,000 inhabitants. These regulations represent "the formal transition to democracy" (Coelho, Pozzoni and Cifuentes, p.174), the decentralisation of spatial planning policies and the introduction of a participatory framework (Arvritzer, 2012) as "the modus operandi" (Caldeira, 2015, p.128).

Through the same perspective, the National Urban Mobility Policy has, as its main aim, the formalising of guidelines and principles for the adoption of mandatory Urban Mobility Plans by local authorities in cities of this size. The Ministry of Cities, created in 2003, was the articulator and guide for local public authorities in the elaboration of Urban Mobility Plans. The municipalities were expected to develop their mobility plan by April 2015, subsequently extended to 2019 (Maranhão, Filho and Santos, 2017). However, as the Ministry of Cities was abolished in January 2019, after the new president's election, and a Temporary Subcommittee on Urban Mobility has recently been put in place (Senado, 2019), the future of these plans and, consequently, broader urban issues, have become unclear.

So far, the policy has included the concept of healthy urban mobility as one of its main principles. The policy establishes the prioritisation of non-motorised and collective means of transportation over motorised and individual ones, the importance of exclusive spaces for non-motorised means and their integration with public transportation (Brasil, 2012). As such, it proposes an alternative way of looking at urban mobility in Brazil away from the over-appreciation of automobiles.

However, the policy does not propose further changes to boost healthy urban mobility or ways to encourage modal shifts from "unhealthy" – private motorised modes of transport - to "healthy" – active transport. Urban mobility is also a social practice (Nettleton and Green, 2014) that represents more than moving from a point to another in the city, it is "linked to issues of identity, culture and social norms" (Jensen, 2014, p.14). In this sense, "behaviour change" programmes are regarded as an essential part of promoting a modal shift away from private car use and encouraging healthy modes of transport (Banister, 2007). Public involvement becomes then essential to promote effective sustainable changes in transport (Banister, 2007). Therefore, this paper explores the way in which the participatory framework is perceived by the Federal Government in relation to urban mobility and draws attention to its main challenges.

1.1. Participatory framework

Before exploring how participation is conceived in the national policy, it is important to highlight some organisational issues involving the development of urban mobility plans. As mentioned previously, the National Urban Mobility Policy directs the responsibility to local authorities in order to elaborate urban mobility plans. Spatial and urban mobility planning are usually administered by different entities at the local level in Brazil, which might result in Mobility Plans arising from disconnected and fragmented actions. In addition, internally, the entities responsible for the execution of the Mobility Plan lack government structure for creating them (Maranhão, Filho and Santos, 2017), especially in terms of public engagement throughout the decision-making cycle - "agenda formation, formulation, decision-making, implementation and evaluation" (Howlett and Ramesh, 2003, cited in Voos and Cattani, 2015, p.13). The way in which the policy is addressed within local authorities reveals a void between planner and society and the lack of transdisciplinarity in "knowledge co-production" (Patterson et al., 2015, p.26). The lack of effort in integrating disciplines and departments affect, not only the quality of the mobility plans, but also the way in which civil society is engaged in the process of decision and policymaking.

In regards to the inclusion of civil society, the National Urban Mobility Policy establishes guidelines for the cooperation in planning, inspection and evaluation of the policy by civil society through some instruments, such as: "collegiate bodies containing members of public authority, civil society and services operators; ombudsman services; public meetings and consultations; communication, satisfaction evaluation and accountability procedures" (Brasil, 2013, p.32). Rather than actively engaging citizens and including all levels of society, these collegiate bodies and the informative approach behind consultations and satisfaction evaluations can be associated to the public authority's aim for public and political acceptability (Banister, 2007, p.76).

As a method of choice, participation can be "distinguished from decision-making by committee, or by voting, or by representative democracy" (Alkire, 2002, p.130). It can be defined as: the "process of discussion, information gathering, conflict, and eventual decision-making, implementation, and evaluation by the group(s) directly affected by an activity" which influences personal value and importance; well-being; dynamic value information; and reflexive effects on identity and culture (Alkire, 2002, p.130).

Therefore, this paper argues that the instrumental role of participation to improve effectiveness, analyse people's need, identify local information and motivate local contributions, has been underexplored in this policy. The right to participation (Lefebvre, 2011) can be considered as a condition to strengthen democracy and one mechanism of achieving legitimacy through trust development, but, in this case, it is not conceived as an instrument to expand people's capabilities and to improve outcomes (Alkire, 2002). In addition, the policy includes no legal mechanism that neither considers participation as a long-term learning opportunity for urban mobility (Jutraz and Zupancic, 2015) nor sets proactive ways of understanding the communities and their mobility challenges.

So far, it is important to highlight the fact that the presence of a "language" - participation - on "paper" – planning policy - does not guarantee its true existence (Nussbaum, 1999), revealing a gap between law and reality that camouflages "undemocratic decisions"

(Voos and Cattani, 2015, p.20) and also excludes the poor. Therefore, the "opening" for citizen participation has not yet subverted the underestimation of ground-level contributions and the benefits that mutual learning between authorities and civil society can create.

3. Conclusion

This paper has explored the trajectory that culminated in merging citizen participation and healthy urban mobility in the Brazilian context, and analysed the elements of the discourse created within a certain social, economic, political, cultural setting and its time-frame (Fairclough, 2005) through the National Urban Mobility Policy. This policy has reproduced the idea of social inclusion existing in previous Brazilian laws without considering its benefits to current urban mobility challenges and reinforcing the limited role of participation in policymaking.

Despite the lack of integration among disciplines and professionals within the local level, the urban mobility plans have the potential to boost more active and healthy ways to move around the city. This paper has promoted the debate on how ground-level contributions could be, not only mechanisms to understand society's needs and desires, but also ways of promoting social inclusion and healthier ways of living.

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Modes of film production in 1950s Italy

Clara Giannini

Abstract

Production studies are a research field that is having more and more resonance all over the world. For this reason, it is important to pay attention to one of the most interesting film production markets of the twentieth century: Italian film industry. Although very small, this country was able to compete with the film industry par excellence, Hollywood, becoming one of its main rivals during the 1950s.

But what was that rendered this industry so fruitful and lucky? Through the analysis of the genres produced between 1945 and 1958, this paper tries to focus on one of the aspects that could give an answer to this question. The genres produced, indeed, give an idea of the preference of the Italian cinemagoers and of the industry, showing what used to attract the public, and allowed Italian movies to surpass the national borders and even successfully reaching the U.S. countries and its cinemas.

Key words: Cinema, production, Italy, 1950s, production companies, film genres

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Clara Giannini holds a Ba in History of Art from the John Cabot University in Rome and an MA in Film Studies from Sapienza University of Rome. Her research interests focus on movies and film production companies. Her prior experiences taught her that any kind of archive, text, or even chat, can hide interesting data: "you never know where you will find the information you need, what you have to do is to be open minded"

Her current research, conducted under the supervision of Prof. Daniela Treveri Gennari, focuses on the Italian film industry between 1945 and 1959. In this research, she explores how many new companies were founded in Italy during this period, in addition to how many and what genre of movies they produced.

1. Introduction

After the Second World War, film industry in Italy grew exponentially. More than 700 production companies were born between 1945 and 1959, and several others - founded before 1945 - were still active during this period. Despite most of them having been concentrated in Rome, the geographical distribution covered the entire Italian territory, from the North (with Milan and Turin) to the South (with Naples and Palermo). This period was a time of great expansion for Italian film industry not only for the production companies founded, but also for the movies produced. Indeed, their number increased significantly: more than 1400 films from 1945 to 1958, according to the chronological list of films published by the Italian national association of cinema and audio-visual industries, ANICA. The beginning of the 1950s saw the maximum peak of production, that started to decrease after the 1955 crisis. The majority of the films were dramas, followed by comedies, adventure movies and comic films. This division gives a first cue of analysis showing the direction film production took at the time, as well as the demand offered to the public and the preferred genres by the population, which attracted so many Italians to movie theatres.

2. Materials and methods

In order to analyse and have an idea of the production companies present on the territory, and of the genres produced and preferred by the Italian industry and people, I have first of all found out all the production companies founded between 1945 and 1959. The reference was Aldo Bernardini (2000)[1], who collected the information about the Italian production companies founded between 1930 and 1995, together with their year of constitution, the number of film produced, the year in which they ended their activity and, sometimes, their location.

I have then identified all the films produced in Italy between 1945 and 1958, according to the chronological list of movies published by ANICA. Searching the titles in the database present in www.cinematografo.it, the website of the magazine 'La Rivista del Cinematografo', which was very famous after the war, I could find out the genres these films belonged to, and group them under 13 tags. The starting point was Marina Nicoli's paper on the Italian movie industry from 1945 to 1965[2], to which I have added 3 more: fantasy, horror and science-fiction.

1 Bernardini, A. (eds.) (2000), Cinema Italiano 1930-1995: le Imprese di Produzione. Rome: Anica.

2 The author identifies 10 genres: drama, comedy, musical, adventure, historical, war, comic, mythological, detective story, and documentary.
Nicoli, M. (2018) '«Historia non facit saltus» The Italian movie industry from 1945 to 1965' [no date].
Available at: https://www.academia.edu/9042421/Movie_financing_in_Italy_after_WWII (Accessed: April 20th, 2018)

3. Discussion

As previously said, after the Second World War, Italian film industry had a noteworthy growth. The companies founded were 770, according to the SIAE data collected by Aldo Bernardini (2000)[3], and most of them (52,34%) lasted only one year. Less than 20 were able to survive for more than 20 years.

Moreover, it must not be forgotten that several other companies - founded before the year took as starting point - were still working. It should not surprise, though, that this period is a time of great expansion for Italian film industry, and for the movies produced, too. And this is the argument I will focus on in this paper: the films produced, and the genres preferred by Italian film industry between 1945 and 1958.

During the second half of the Forties and throughout the Fifties, the number of movies increased significantly. Most of the companies produced just one movie (427), and only 3,25% could name more than 20 titles on their lists. Moreover, it is interesting to notice that most of the films were made by companies with a small corporation stock, between 500.000 lire and 1 million. On the contrary, the companies which produced less films were those whose stock was included between 1 and 2 million. The businesses with the highest stocks (more than 50 million) were just 9 and produced only 134 movies.

The total amount of films produced in this period is 1477. 235 were co-productions among Italian companies (224 between two companies, and 11 among three). The beginning of the 1950s saw the maximum peak of production, that started to decrease after the 1955 crisis of the industry. Most of the films were dramas, followed by comedies, comic films and adventure movies.

1.1. Genre popularity

Through the number of film produced, it is possible to identify the most popular genres.

With almost 600 movies, the drama reached the top (591) (in other words, 40% of the total amount of films). From the timeline developed through Palladio, a tool for networking analysis, it is possible to see that most of the dramas were produced during 1952, and that the period during which their production increased is between 1952 and 1954. However, the years when dramas occupied most of the film market (more than half of the offering) were between 1946 and 1949, so right after the war. During the following years, their number decreased, and even if they represent the most important genre produced, the market started to present other genres.

3 Bernardini, A. (eds.) (2000), Cinema Italiano 1930-1995: le Imprese di Produzione. Rome: Anica.

The second most popular category was comedy, with 343 films (23,22%). From the timeline, it can be seen that most of them were produced between 1953 and 1958, with a clear peak in 1953. There was a decrease after the crisis of 1955, but it seemed to increase again by the end of the decade.

Then, there are comic movies. They represented 7.5% of the film produced (111), and its most fertile year was 1951. During the rest of the period under analysis, this genre was popular but not quite exploited, principally because related to specific actors, like Totò and Peppino De Filippo.

Adventure movies were 108. With 7,3% of the total production, they are right after comic movies. The genre had interesting peaks in three occasions: 1953, 1955 and 1958.

Another genre well distributed within the entire period was musical movies. With 84 films between 1945 and 1958, they represented 5,7% of the production of the time. The genre was popular, and its distribution over the years was quite similar and numerous.

Documentary and history follow musicals, considering the genres according to the number of film produced. Documentaries were 51, while historical movies were 50. They represented 3,45% and 3,39% of the total amount of films produced. The production of documentaries increased during the 1950s, after the new cinema law in 1949, known as Andreotti law[4] (from the name of the politician that designed it), which was issued to sustain and promote Italian cinema and its growth. The production reached its peak in 1956, but even during the following years its presence in the market remained quite strong.

Historical movies had a different distribution among the years. It was mutable and changed year per year, generally with an increase and a following decrease. The most successful year for this genre was 1954, but also during 1952 and 1958 it occupied a quite interesting position within the scale of movies produced.

The genres that produced less than 50 films were: detective story, 33 movies (2,23%); war, 24 films (1,63%); fantasy, 17 movies (1,15%); mythological, 3 films (0,2%); horror and science-fiction, 1 movie per genre (0,07% each). Detective stories were produced above all in 1947, with a peak in 1950, to which a decreasing interest followed during the second half of the decade. War movies were present above all in 1952, and also a bit less in 1946 and 1954. Fantasy films were produced above all in 1950, and their presence can be found right before and right after this year. During the rest of production, the presence of these movies was very rare.

4 For a better understanding of the law, please see: Quaglietti, L. (1980) Storia economico – politica del cinema italiano 1945-1980, Rome: Editori Riuniti

The number of mythological movies reported by cinematografo.it database is only 3 (one of the most famous, Ulysses[5], is classified as adventure). However, as we will see, they were successful among people, resulting fruitful talking about box office. As said, they were produced in 1952 and 1958, opening the genre to its triumph in the 1960s.

If we make a brief analysis of the genres produced over the years, we can see that the only genres that cover the entire period are comedy, drama, musical, and history. Moreover, we can see that:

- documentaries were produced for 12 years out of 14
- adventure movies and detective stories were not produced only in 1945
- mythological films were produced only in 1952 and 1958
- horror and science-fiction movies were produced only in 1957 (the first genre) and in 1958 (the second one)

1.2. Genre and box office

In order to study the relation among films, genres and box office, this last data has been grouped into eleven groups, according to the information found in the dictionary of Italian films (Poppi, 2007)[6]. It depends on the amount of the box office, which goes from up to 1 million to more than 2 billion, and it includes even the voices "not mentioned", "unknown", and "not present"[7].

From a first analysis, it can be seen that most of the films are included within the group 7, so their box office was between 200 and 500 million lire. They were 387 movies out of 1477.

After this group, there is group 6 (with box office between 100 and 200 million lire). It includes 298 films, and then the group 5, with 216 movies.

5 Ulysses
Production: Lux Film
Director: Mario Camerini
Actors: Silvana Mangano, Kirk Douglas, Anthony Quinn, Rossana Podestà, Jacques Dumesnil
(ANICA, 1954)

6 Poppi, R. (2007) Dizionario del cinema italiano, I film vol. II – Tutti i film italiani dal 1945 al 1959, Rome: Gremese Editore.

7 For an easier classification to analyse the results, the amount of the box office has been divided among eleven groups. Here are the groups:
group 0 includes those films whose box office was not mentioned;
group 1 includes those movies whose box office was defined as "unknown";
group 2 those films whose box office was not present;
group 3 those films with a box office amount arrived to 1 million;
group 4: box office between 1 and 50 million lire;
group 5: box office between 50 and 100 million lire;
group 6: box office between 100 and 200 million lire;
group 7: box office between 200 and 500 million lire;
group 8: box office between 500 million lire and 1 billion;
group 9: box office between 1 and 2 billion;
group 10: the box office amount was more than 2 billion.

What is interesting is that in 203 movies the box office was not mentioned (and most of the time, it depended on the fact that they were co-productions, and the Italian companies participated as a minor partner, so we do not have information about this data).

There are even 168 films that attracted a small portion of the public, and they collected between 1 and 50 million lire. Following, there are: 94 films in group 8; 61 whose box office is unknown (group 1); 36 not present in the dictionary; 8 belonging to group 9; 4 which collected up to 1 million lire (group 3). Finally, one of the most interesting information: there is just one film whose box office went beyond 2 billion lire; it is Ulysses by Camerini. According to the dictionary and even ANICA list, the film was produced by Lux Film, with the participation of Ponti and De Laurentiis. However, the movie could be a co-production between Ponti-De Laurentiis Cinematografica (whose names appear in the credits) and Lux Film. Another interesting fact is that the film is an international co-production (an American co-production) that resulted to be the most watched movie of the time.

4. Conclusions

What we have seen in this paper is part of the modes of film production in 1950s Italy. It is a work in progress that starts to give an idea of how fragmented, even though powerful and fertile, was the Italian film industry of the time, based principally on investments on dramas and comedies.

The strength of this industry is demonstrated by the rich and fruitful production, that was able to surpass the Italian borders, and reach international recognition. Many films, many actors, directors, scriptwriters were worldwide known, and many collaborations were established in this period. This industry laid the foundations for the golden age of the Italian cinema, and for the so famous commedia all'italiana.

Moreover, it cannot be excluded that 1950s industry could have been the reason of so many unprepared people who improvised themselves producers due to this huge success of the field. It could have delineated the Italian panorama as one made principally of small and medium companies born to produce just one film. Maybe a drama, if we look at the numbers, and consider how spread the genre was.

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Defining and restoring the cultural landscape and place-identity of historic cities: the case of Mérida, Yucatán, México.

Sheila Isabel Irigoyen Zozaya

Abstract

Cultural landscapes as any other places in the city are inherently changing all the time. In the past, traditional cultural landscapes were characterized by their symbiotic connection with local communities and their ability to adapt to the environment. However, many of them have experienced fundamental transformations with severe impact on the ecosystem of human settlements. Unsustainable solutions in architecture and urban design, as well as the homogenization of cultural landscapes are becoming common phenomena affecting the local place-identity of cities (Butina Watson and Bentley, 2007; Adam, 2011; Brislin, 2012; Hopkins, 2015).

The city of Merida is a representative case. Merida is the capital of the Yucatan state which concentrates the political, economic and cultural power in the region. For many years, these enticements and its geographic location have attracted changes in the urban scenery. From the sixteenth to the first half of the twentieth century, new trends transformed the Mayan cultural landscape; yet, key heritage values endured and evolved thanks to their effectiveness and resilience. Nowadays, these values have been forgotten and the city is becoming an anonymous entity, poorly defined and insensible to the value of environment (Chico, 2002; Román, 2002; Espadas, 2003; Peraza, 2008). This paper discusses the holistic approach of cultural landscapes and their current situation in Merida.

Keywords: cultural landscapes, place-identity, heritage, sustainable, key-values, Mexico, Merida.

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Sheila Isabel Irigoyen Zozaya is a Mexican architect, a professional artist, and an Associate Lecturer at Oxford Brookes University. She holds a BA in Architecture and a master in Environmental Urban Design from Universidad Autónoma de Yucatán. Prior to joining Brookes, Sheila worked as a surveyor, as well as an architect and urban designer for the city council in Merida, as a research assistant supporting the inventory of historical monuments for the Historic Centre of Merida, and as a Lecturer for a BA in Architecture and Habitat design.

Her doctoral research, conducted under the supervision of Professor Georgia Butina Watson and Dr. Laura Novo de Azevedo, focuses on Cultural Landscapes and Place-Identity of Historic Cities, with Merida (Mexico) as her case study. In this research, she aims to identify local heritage values and incorporate them to new settlements for more sustainable solutions.

1. Introduction

1.1. Cultural landscapes: a holistic concept

Cultural landscapes are more than a defined physical zone. They are clearly delimited geographical areas where nature and culture diversity have coincided over a long time, shaping a distinctive landscape (UNESCO, 1992; Birnbaum, 1994; Robertson and Richards, 2003). They are holistic concepts (Selman, 2006), remarkable places immerse in a greater context due they represent a 'closely woven net of relationships between local communities with their tangible and intangible heritage as well as its natural environment' (Rössler, 2006: 334).

Even though the concept of cultural landscape differs between people and its perception changes over time (Jacques, 1995; Solymosi, 2011), what remains as one of the core characteristics is the outstanding universal value for the complex interaction between people and nature (Jacques, 1995; Rössler, 2006). This definition also envisages two important aspects of cultural landscapes: firstly, people and nature work together in the definition of the landscape; and secondly, a solid bond is stablished between them. Therefore, this author has identified three main approaches to achieve the virtuous circle of cultural landscapes in terms of their dynamic interaction, perception, and inter-intragenerational (see figure 1), something that is ascertained in other well-recognized settlements, such as the city of Oxford (see figure 2):

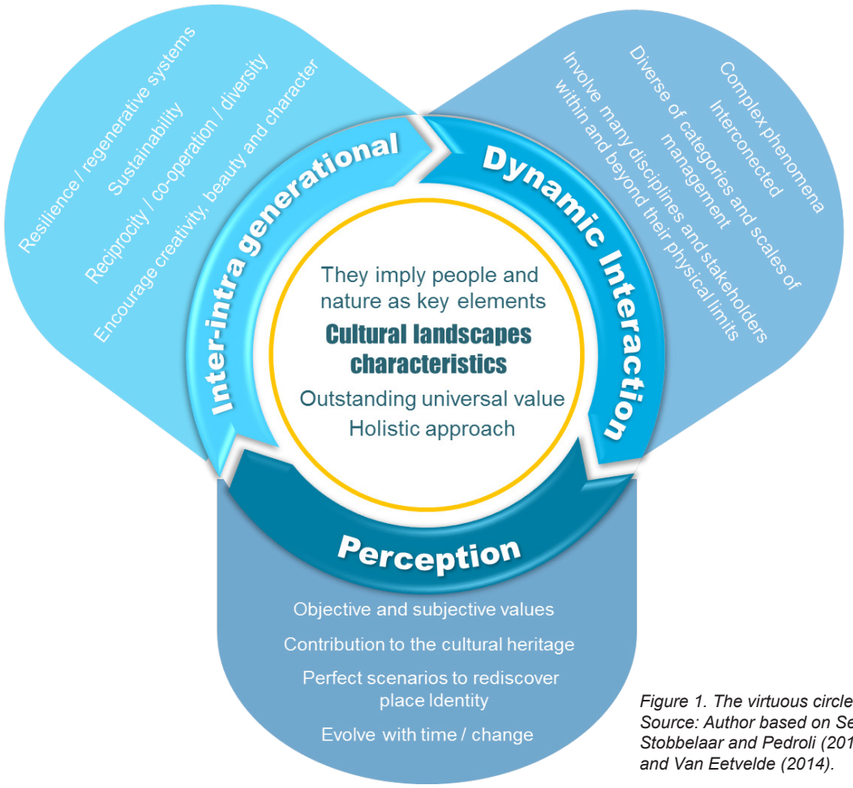


Figure 1. The virtuous circle of cultural landscapes. Source: Author based on Selman and Knight (2006); Stobbelaar and Pedroli (2011); Valles-Planells, Galiana and Van Eetvelde (2014).

Figure 2. Oxford Skyline. A place of well-recognized traditional cultural landscapes. Source: A watercolour made by the author, 2019

2. Materials and Methods

Due the research topic is complex, primary and secondary data were collected using multiple sources of evidence. This will address a broader range of information, exploring in-depth perspectives and behaviours that will nurture holistic explanations (Yin 2014), in order to understand the evolution, development and mediating factors that have contributed to shape the cultural landscapes and place-identity of Merida. Data types and collection techniques were carried out through:

A) Physical urban form data. Firstly, typo-morphological analysis was implemented by studying the physical components of the cultural landscapes and by tracing the historical background of different stages of the city, in order to understand how the historical urban transformations at different scales of the city lead into different urban morphological patterns (Punter, 1997; Butina Watson and Bentley, 2007). Secondly, local perceptions of people were collected using qualitative methods such as mental maps and drawings. Its purpose is to gain greater insight into the views and experience of people when they use local cultural landscapes and to find out the values attached to the urban form.

B) Data from semi-structured interviews, focus groups and one seminar. Its purpose is to collect facts or understanding experiences, opinions, attitudes, processes or predictions of cultural landscapes' users. In order to do so, first, a basic profile of interviewees were defined in terms of job role, qualifications, experience, age and users of the urban space, as to demonstrate that the interviewees have the knowledge to offer useful information on this research (Rowley, 2012; Bryman 2012; Bolio, 2012; Yin, 2014).

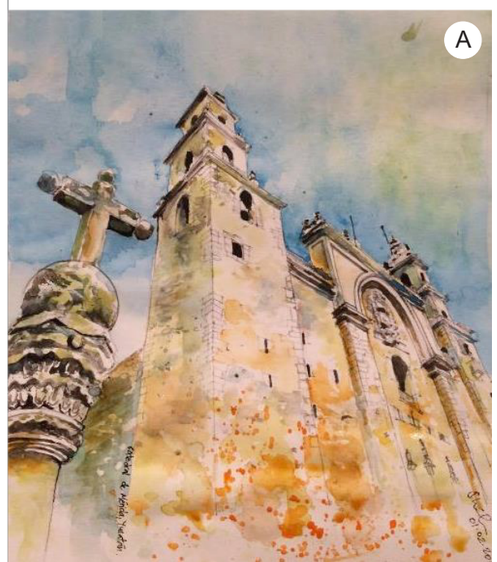
3. Results and Discussion

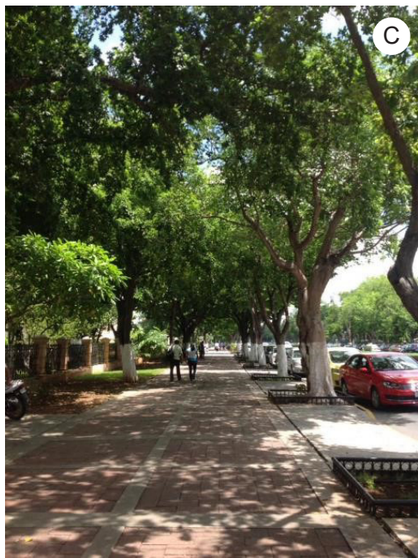
1.2. The situation of Cultural landscapes in Merida.

It is well-known that the Solar Maya as a basic plot unit within the Maya tradition in Yucatán, is the symbol of sustainable design and identity that shaped the development of the local cultural landscape for centuries (Tello, 1995; Yampolsky, 1993; Roman, 2002; Chico, 2002). However, from the sixteenth century during the Spanish Conquest and between the end of the nineteen and the first half of twentieth century -known as the Porfiriato and Regionalism era-, the Mayan cultural landscape was transformed. Yet, key aspects remained thanks to their ability to adapt to the site conditions, such as the reuse of previous settlements; construction systems adapted to new spatial configurations; clear morphological patterns; good connectivity and respect for the natural characteristics of the site (Chico, 2002; Román, 2002; Espadas, 2003; Peraza, 2008).

Today, the city of Merida is becoming an anonymous entity, poorly defined and insensible to the value of environment (Peraza, 2008). Lack of historical and sustainable consciousness are the common denominator of new proposals that imitate international consumer trends uncritically (Peraza, 2008; Adam, 2011). On the other hand, week planning strategies, regulatory framework and governance processes have also contributed to these problems as they are mainly regulated for political and individual commitments. The rise of incompatible land uses (Peraza, 2008; Bolio, 2012) is a reality, whilst new developments are manifested as a concrete city affecting the habitability of the urban space (Alonso, 2003; Peraza, 2008; Tello, 2011; Canto, 2013).

Figure 3. Traditional landmarks in Cultural Landscapes of Merida, Historic centre. Images A and B correspond to the Colonial Cathedral and the Cloister of the Ex-Convent of Mejorada respectively. Image C shows a typical urban space with trees and shades in Paseo de Montejo. It was designed and built during the Porfiriato era. Even though the physical configuration differs from the Mayan houses, key-heritage values remained and where used to design new spatial configurations. Source: Watercolours made by the author (2015, 2017), Image C by the author (2018).





Merida has traces inherited from the past that still survive and are indispensable in its urban development (Peraza, 2008). Heritage values represent the local culture and they have been able to evolve over centuries (Yampolsky, 1993; Butina Watson, 2015). They also represent more friendly sustainable practices to design the city.

4. Conclusion

In recent years, the relation between cultural, heritage and place-identity approaches have gained importance in multidisciplinary research and urban design worldwide (Bentley et al, 1985; Carmona, M. et al., 2010; Plieninger and Bieling, 2012; Stigsdotter, 2005; Punter, 2007; Butina Watson, 2015). In the case of Merida, these approaches have been widely discussed in theory (Chico, 2002; Román, 2002; Espadas, 2003; Bolio, 2012; Tello, 2012; Peraza, 2014). Nevertheless, it is not clear how these theories can be adapted and put into practice in order to improve the relationship of local cultural landscape and place-identity.

On the other hand, the cultural landscape approach has been little explored and still needs to be defined and analysed as an essential component in urban design. Additionally, there is no methodology that unites all the components in order to achieve a sustainable urban development in Merida. Therefore, the product of this research will aim to fill the gap and contribute to new knowledge in the following ways:

a. To define what key values or principles are necessary to restore the cultural landscape and place-identity of Merida in order to preserve the local heritage.

b. To develop an operational methodology for integrating the key heritage values in the local urban practice that helps to achieve a sustainable development.

c. To generate of new knowledge and recommendations which can be used in research, academia or urban practice in Merida.

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The Design and Development of a 3 Sensor Control System for Condition Monitoring Applications

Ben Noble

Abstract

The research investigates a novel approach for the development of a 3-sensor control system for condition monitoring applications and finding methods for minimising inherent interferences. This is needed to help improve equipment life and reduce downtime during production hours; continuous data gathering enables failures to be predicted in advance.

The methodology for each of the individual sensors focussed on determining the deteriorating variable which can be monitored to determine the overall level of functionality of the process. The methodology also required that primary and secondary data sources be analysed to determine where the boundaries of equipment functionality are placed; which is then utilised by the control system to derive decisions to provide alarm or corrective actions. The results, from preliminary testing, show successful implementation of intermediary circuitry for use between the new and existing control system. This proposed approach is better than other approaches because it covers and combines 3 main areas of concern for pressings machines into one control system. Current methods are performed manually, and at set intervals (due to the cost), whereas this system is automatic and can be programmed to monitor whenever deemed necessary.

Keywords: Condition Monitoring, Automation, Interference Reduction, Microcontroller, Multi-Sensor

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Ben Noble holds a BSc Electronic Engineering (Hons) from Oxford Brookes University, which he completed, achieving a 1st, while working for BMW. He is still currently working for the BMW Group UK, in the Press Shop in Plant Swindon. At the same time, Ben is pursuing his part-time MSc by Research at Oxford Brookes University, about to start his second year. So far, Ben has focused on developing his skills on Control, Electrical and Electronic Engineering work within the broad maintenance department.

His current research project, supervised by Steve Barker, Khaled Hayatleh, and Mohamed Ben-Esmael, aims to design and develop a multi-sensor system for condition monitoring purposes with automated features. Ben's main research interests are sensor design, advanced industrialised automation and control systems.

1. Introduction

In industry the downtime caused by preventable machine failure is expensive. Condition Monitoring (CM) is an important process to prolong the working lives of machinery and prevent machine downtime during production hours. CM is applicable in two formats: trend monitoring and condition checking. Condition checking is a process of taking measurements at set, periodic, intervals and comparing the results to anticipated values: if differences are apparent then the problematic piece of equipment can be investigated further. Neale and Woodley (1975) describe trend monitoring as a continuous process whereby a constant stream of data from the device is gathered and analysed.

A multi-sensor system, which integrates with existing Programmable Logic Controller (PLC) based control systems, is most effective when utilising both CM processes. The data should be wirelessly transmitted to a central device for analysis by engineers; it is also advantageous to locally provide alerts to the PLC control system. A further advantage of this system is that it will attempt to automatically correct failing equipment by adjusting equipment parameters where applicable. Long term CM data gathering can also form the basis for a comprehensive predictive maintenance strategy (Mobley, 2002). The aim of this study is to improve CM processes in metal forming press shops by developing a control system with 3 sensors: Clutch and Brake (C&B) pad wear sensor; Vibrational Analysis (VA) sensor and Non-Intrusive Pipe Pressure (NIPP) sensor.

The structure of the remainder of the paper is as follows: in the Materials and Methods section, the basis of each sensor, and proposed methods, are discussed. The power and interfacing circuits, required to link the new and existing control system, are discussed and initial designs, with calculations, are shown. The results from the simulations of these designs are discussed in the Results and Discussion section and the accuracy of the result is compared to the expected theory. The novelty of this study is rooted in its combination of 3 different CM areas into one control system, in contrast to (Orhan et al., 2006) & (Sadeghioon et al., 2014), whom focus on one area in isolation. This study also focuses specifically on pressing machines and as such the sensors will be tuned for this use primarily to attain more accurate results while minimising interferences the pressing machines suffer from.

2. Materials and Methods

The control system which has been developed in this study consists of the 3 sensor circuits, 3 wireless transmitters, interfacing circuits for connections between the two control systems, power circuitry and a central unit which graphically displays requested data. A block diagram schematic is shown in Figure 1.

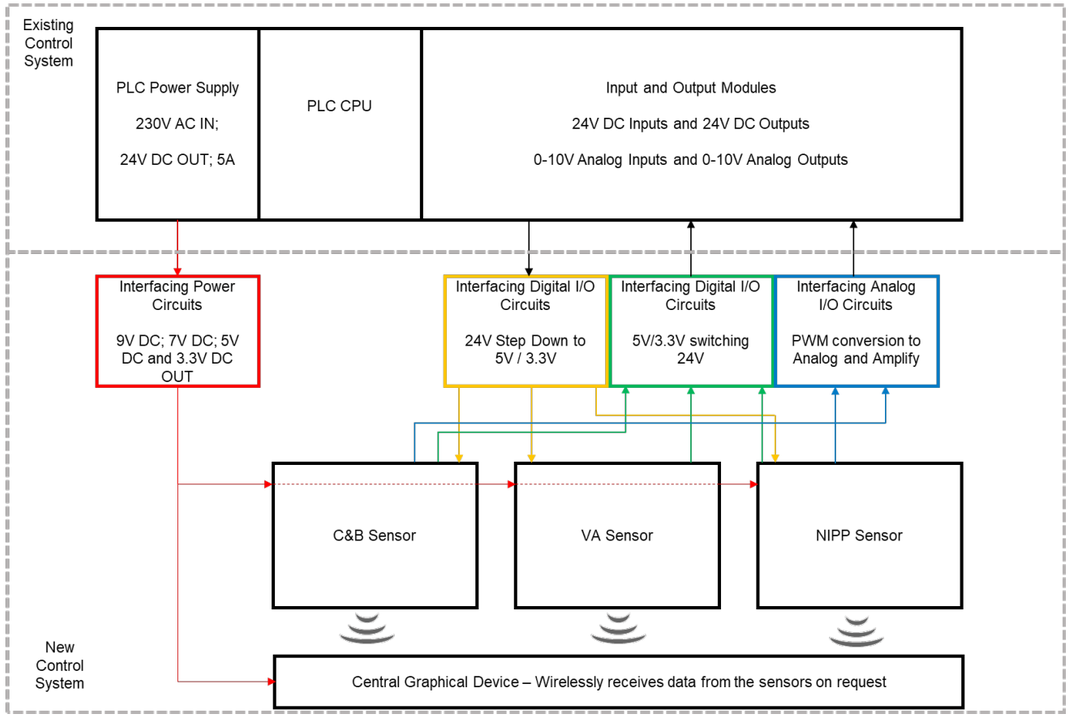


Figure 1. Block Diagram Schematic of Control System

1.1. C&B Sensor

The C&B sensor was used to monitor the wear of the brake pads (Figure 2) in a C&B unit (Figure 3) which drives a mechanical press. The unit used these pads to apply the brake and over time these pads wore down to unsuitable levels. The data acquired by this sensor allowed the PLC to decide which corrective action to take automatically. Either: adjusting the stopping windows, the initial brake position or the air pressures to slow the ram down.

The wear of the pad was determined by measuring a loss of thickness. Two methods of determining this wear were highlighted through research: measuring the distance with an Infrared distance sensor and the use of a rack and pinion setup with a rotating optical encoder: the distance to measure was set to be up to 15mm.

Figure 2. Brake Pad

Figure 3. Clutch and Brake Unit

Infrared sensors were chosen, over ultrasonic sensors, because of their average faster response time (Mohammad, 2009) and the fact that their performance was not tied to the varying velocity of sound in air – which changes with humidity and temperature (Carullo and Parvis, 2001).

The microcontroller needed to send this data to the PLC – the chosen Arduino microcontroller lacked a dedicated Digital to Analog converter but alternatively its Pulse Width Modulated (PWM) outputs were chosen. The PWM signals needed to be converted for the PLC to read them properly; this method is discussed in section 3.4.

Another method utilised a rack and pinion setup with a rotational encoder to provide precision measurements. This method was immune to some of the disadvantages the infrared setup suffers from: namely the problem of airborne particulate debris which interrupt the signal. By securing the rack to the stationary plate and connecting the pinion gear to the moving plate a distance has been measured by connecting a rotary encoder to the pinion gear. The encoder provided a digital pulse which was converted to a distance. The disadvantages identified were mechanical wear, and eventual backlash, in the gears.

1.2. VA Sensor

The VA sensor was used to monitor the vibrations present in motors, bearings or pumps to determine if mechanical wear was present. Excessive vibrations in these pieces of equipment have caused destructive failures which necessitate complete replacement of the affected equipment.

The research focussed on two main methodologies: the use of Micro Electrical Mechanical (MEMS) accelerometers or using microphones. The microphone system was used to detect the waveforms generated by vibrations in the equipment – the strength of these vibrations determined if the equipment was close to failure (Tandon and Choudhry, 1999). However, the press shop is very loud and this disturbed the microphone too greatly; any feasible results would have required extensive filtering.

The MEMS VA sensor has been used to measure vibration as an acceleration. The data was measured in the time domain, then transformed to the frequency domain by using the Fast Fourier Transform (FFT) (Orhan et al., 2006) – the FFT was computed quickly using the Python programming language. The necessity of being able to perform FFT was a restriction on which microcontroller was used; this is why the Raspberry Pi was chosen.

Velocity is another method of measuring vibration; and it was represented , throughout research, as:

$v = \int_0^t a\,dt$, where t is the period monitored. The electrical integrator circuit would have required the use of capacitors, resistors and op-amps (Brüel & Kjær, 1982); but these components typically have high tolerances whereas the use of a digital integration function in software is more accurate and as such was chosen as the integrating method.

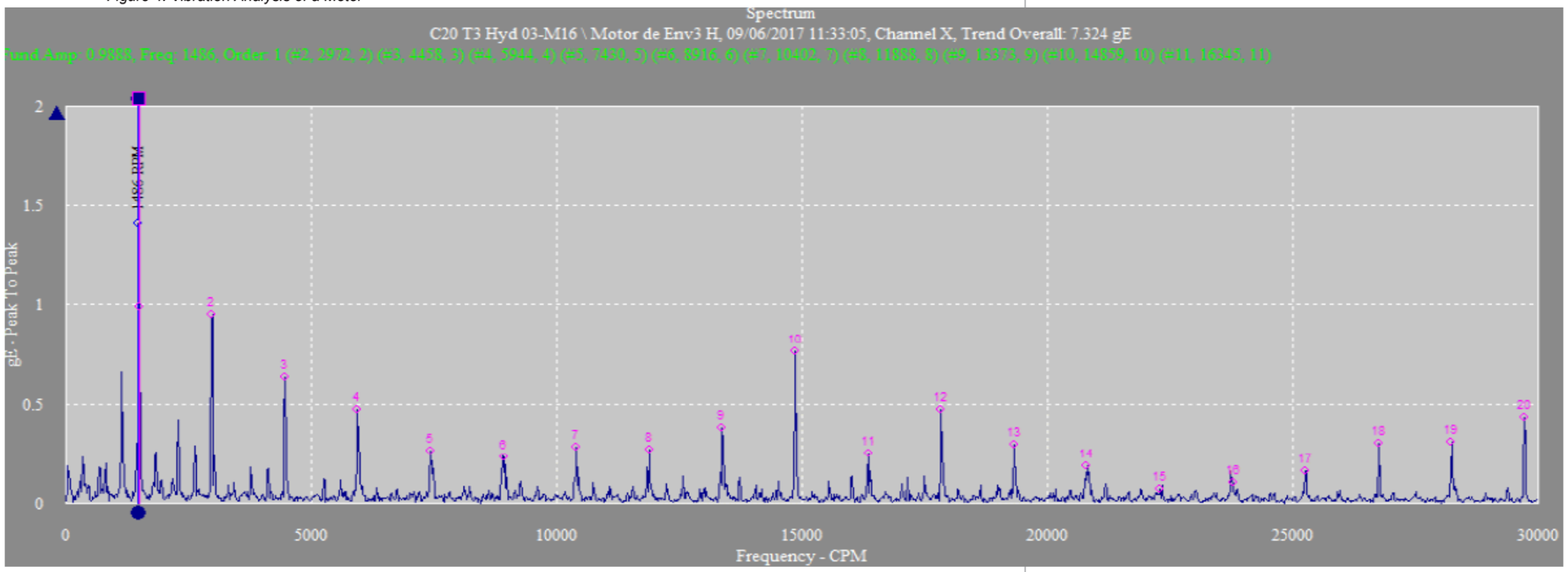
A common issue with MEMS accelerometers that collect data over time is drift error. A Kalman filter was chosen to be used to remove noise and errors from the data which can be exemplified when integrating the data. The Kalman filter is an estimator because it uses previously viewed data as a basis for error removal (Arras and Tipaldi, 2012).

Previous secondary data which has been gathered, using a manual and expensive process, provided a template to compare results from the new sensor to. An example of VA performed on a motor is seen in Figure 4 – a graph of gE Peak to Peak vs Frequency CPM. The corresponding peaks refer to the fundamental frequency and its harmonics.

1.3. NIPP Sensor

The NIPP sensor has been used to monitor for pressure changes over time in a metal pipe – the existing pipe work could not be retrofitted for standard pressure gauges so an externally mounted sensor, integrated into the PLC control system, was deemed necessary for providing data. This data was used to check for sudden pressure loss and to provide a warning, or pump shut off signal, to the PLC.

Figure 4. Vibration Analysis of a Motor



An identified method of monitoring internal pipe pressure was to use strain gauge measurements (Sadeghioon et al., 2014). The strain gauge is a device whose resistance changes with extension and if implemented into a bridge configuration, a change of voltage is measured as the strain changes (Horowitz and Hill, 2015).

Strain is related to stress via the Young Modulus ratio which depends on the material. Therefore, hoop stress calculations were used to determine the internal pressure as long as certain variables were known. (FAMU FSU, no date).

The pipes also faced thermal changes over time so a thermal monitoring circuit was designed to be included which enabled a thermal correction to be made. Methods highlighted to compensate for the thermal changes included temperature self-compensating strain gauges. Another method found was to apply a temperature coefficient to the strain gauge factor – the temperature was to be continuously monitored and adjustments made to the strain readings as they occurred (HBM, no date).

1.4. Power and Interfacing Circuits

The sensors needed hardwired power. The PLC control system used a 24V 5A power supply whereas the Arduino and Raspberry Pi needed a 7-12V supply (Arduino, no date) and 5V supply (Raspberry Pi, no date) respectively. The current requirements varied based on the actions performed.

The 24V supply was lowered to another voltage while providing a steady load variable supply. A voltage regulator was used for this, there are two main types of regulator: the linear regulator and switching regulator. Linear regulators are less useful than switching regulators because they dissipate a lot of power, as heat, which requires large heatsinks (Horowitz and Hill, 2015). Whereas, switching regulators are more versatile and have been used with all circuits.

Figure 5 shows a basic switching regulator; a steady voltage output is supplied by the capacitor and inductor. The subsequent discharging and charging cycles are controlled by the high frequency oscillator switching the transistor.

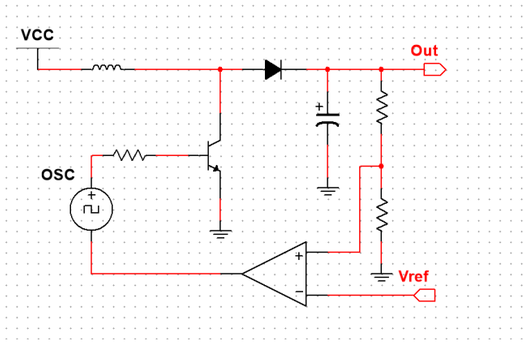


Figure 5. Basic Switching Regulator

The conversion from a PWM signal to an analog signal has been completed with a low pass passive RC filter. The filter blocked the analog part of the PWM signal and left a pure DC voltage which was then referenced as an analog representation of the PWM output (Horowitz and Hill, 2015).

For the design the voltage ripple of the output and the PWM frequency are known – this is 490 Hz (Arduino, 2019).

The PWM is 8-bit, meaning 256 different levels were available and with a 5V peak each level represents 19.5mV. To avoid rounding errors, the ripple was determined to be no bigger than 5mV.

Metivier (2013) described equations for low pass passive filters: calculating the attenuating factor and the 3dB attenuation frequency (break frequency). Equation 1, shows the attenuation required to achieve the predetermined 5mV ripple and Equation 2 shows the break frequency calculation.

$$A_{dB} = 20.log\frac{v_{ripple}}{v_{PWM}} = 20.log\frac{5mV}{5V} = -60\,dB \quad (1)$$

$$f_{3dB} = f_{PWM}.10^{\frac{-60}{-40}} = 490.10^{-1.5} = 15.5\,Hz \quad (2)$$

Equation 2 used '-40' as part of the calculation because a 2nd order filter was designated. The capacitor of the filter was set to 1µF and Equation 3 shows how the resistor value for the filter was found. A second order filter contains two first order filters cascaded one after the other.

$$f_{3dB} = \frac{1}{2\pi RC}; R = \frac{1}{2\pi C f_{3dB}} = \frac{1}{2\pi.1\times10^{-6}.15.5} = 10268\Omega \approx 10k\Omega \quad (3)$$

The PWM conversion circuit was simulated in Multisim and the results are shown in Section 4.

A different circuit that converted a 24V digital output to a 5V digital input was also designed: a potential divider. The equation for a potential divider is shown in Equation 4 – with results in Section 3 (Horowitz and Hill, 2015).

$$V_{OUT} = V_{IN}.\frac{R_2}{R_1+R_2} = \frac{V_{IN}.R_2}{R_1+R_2} \quad (4)$$

Then, R_2 is set to 10kΩ, V_{OUT} to 5V and V_{IN} to 24V.

Rearranging (4) gives:

$$24.10\times10^3 = 5.R_1 + 5.10\times10^3\ ;\ 240\times10^3 = 5R_1 + 50\times10^3$$

$$5R_1 = 190\times10^3 \therefore\ R_1 = \frac{190\times10^3}{5} = 38k\Omega$$

The final interfacing circuit transformed a 5V digital output from the microcontroller to a 24V digital input. The circuit was based on an optocoupler, with a phototransistor setup: an infrared diode shined onto a photosensitive transistor which switches the output.

The output range of the optocoupler needed to permit at least 24V - an EL817 optocoupler, (Everlight, 2010), can handle 36V and was selected. The input voltage was limited to 1.4V due to the infrared diode limitations. A potential divider was shown to be neces-

sary to step from 5V to approximately 1.4V. The circuit is seen in Figure 6. Setting R2 to 1kΩ, with Vout being 1.2V and Vin being 5V, using Equation 4 again, R1 was found to be approximately 3.2kΩ.

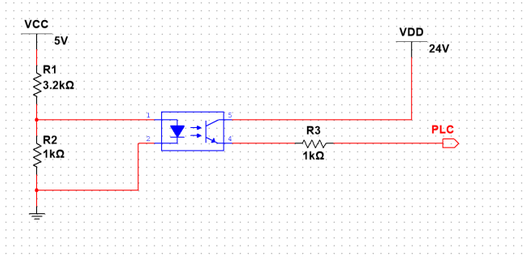


Figure 6. Optocoupler Circuit

3. Results and Discussion

Simulations and results analysis have been completed for the power circuits, interfacing circuits and wireless transmission circuits. A prototype of the Central Graphical Device has also been constructed.

The PWM to Analog circuit can be seen in Figure 7. A 5V peak-to-peak PWM signal was provided to the input of the 2nd order low pass passive filter and an oscilloscope monitored the input and output (Figure 8). The input signal had a duty cycle of 70%; meaning a value of 5V*0.7=3.5V was expected after filtering. The output voltage read around 3.5V with a maximum ripple of 5.161mV which was close to the theoretical value – the difference was accounted for by the rounding of the resistance values.

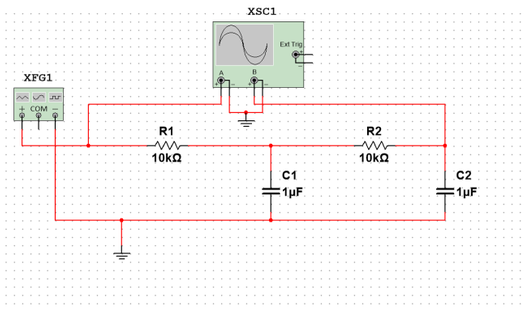


Figure 7. 2nd order low pass passive filter

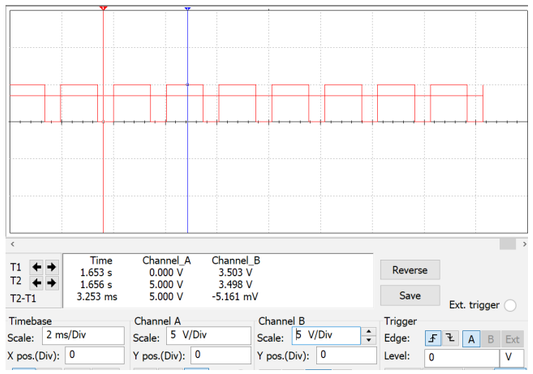


Figure 8. Graph of PWM input to Analog output

The bode plots in Figure 9 and Figure 10 show the 9dB attenuation and 60dB attenuation.

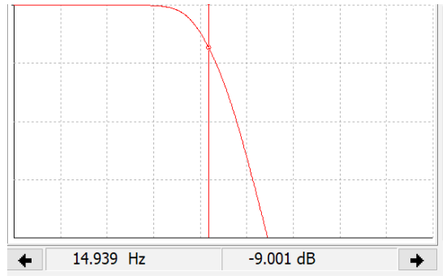


Figure 9. 9dB attenuation

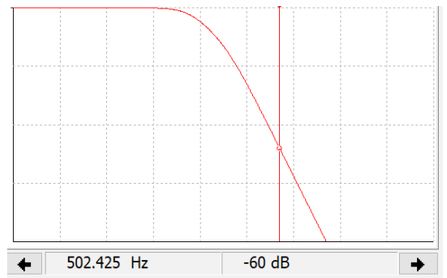


Figure 10. 60dB attenuation

The theory stated that at 15 Hz that there would be a 3dB attenuation, however, due to the cascading filters, the output at the 2nd filter will be a 9dB attenuation. This proved that the analog signal was removed from the signal (Metivier, 2013).

Palacherla (1997) used a single order low pass filter, with amplification via an op-amp, yielding insufficient attenuation – therefore, the chosen method to use a second order low pass filter is more suitable – despite the extra cost. However, Palacheria, also mentioned that a higher order active filter may have been useful if the amount of noise generated was too high. The necessity of this remained to be seen as the results from simulations showed sufficiently high attenuation.

The second bode plot showed the PWM frequency, of approx. 500 Hz with an attenuation of 60dB – no discernible 500 Hz signal is getting through the two filters.

The 24V to 5V divider was setup as described by the theory, Figure 11 shows this.

A steady output of 5V is clearly visible. Both resistors are easy to source.

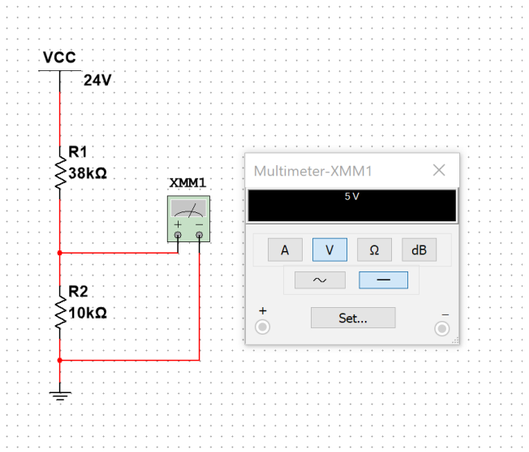


Figure 11. Pot Divider

4. Conclusion

In conclusion, the circuit designs have shown, through simulations, results which align with the theoretical predictions. The simulation results showed a ripple of 5.161mV, where the target was 5mV, which means there was sufficient suppression. The cut-off frequency, at -9dB, is 14.939Hz in the simulation compared to 15.5Hz in the theory; this small deviation is insignificant to the final result.

The interfacing circuits have provided a means for communication between the two control systems ensuring both the existing and new control system can be integrated together to form a combined control system.

The C&B sensor algorithms for determining actions to be taken have been written. The VA sensor has had analysis of existing data to determine the ranges and parameters of which to design the sensor thresholds undertaken. Also, the Python programming library for FFT has been explored via examples and data sets from sensors. Data about the pipes and temperature variations over the course of a day have been gathered to ensure accurate theoretical calculations for comparison to the actual data.

Overall, the next stage is for the prototyped solutions to be tested more thoroughly to provide results which can be compared to the theory set out in the research. This includes utilising the built PLC training rig with mimicked inputs and outputs, representing press signals, to use with the prototypes before finalising designs after revisions.

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Why we should stop worrying about The Trolley Problem when it comes to designing autonomous moral artificial intelligence

Rebecca Raper

Abstract:

Variations of The Trolley Problem, initially introduced by the philosopher Philippa Foot (1967), are frequently used to argue the case for autonomous moral artificial intelligence (AMAI).

The argument goes: (1) as machines become ever more autonomous they are likely to come across ethical dilemmas, such as those highlighted by The Trolley Problem (Foot, 1967); (2) in such situations we would like autonomous machines to make the right ethical decision; therefore, (3) we need to posit AMAI with some moral capacity to allow them to make those right decisions.

In this paper, I discuss how (1): autonomous artificial intelligence may never come across the type of ethical dilemmas described by Philippa Foot (1967). I also debate that (2): even if such situation could exist, AMAI may not be able to identify one right decision. The discussion and debates in this paper do not argue we should dismiss the creation of AMAI, but that we should not be worrying on finding a solution to the Trolley Problem when designing them. I demonstrate how this is further evidenced by the problems that scientists working within this area face. The paper closes arguing how the Trolley Problem can be used differently to help create AMAI.

Keywords: Trolley Problem, dilemma, ethics, artificial intelligence, autonomous vehicles.

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Rebecca Raper holds a BA (hons) in Philosophy, an MA in Philosophy and a PgCert in Psychological Sciences. Altogether, she has an academic background in philosophy, with a minor specialization in psychology. After graduating from her MA in Philosophy, she worked in Information Technology departments for several years, working as an analyst. Her research interests span across philosophy, psychology, cognitive science, computer science and mathematics, with a particular interest in understanding how the mind works.

In her doctoral studies, conducted under the supervision of Nigel Crook and Matthias Rolf, she focuses on autonomous moral artificial intelligence (AMAI). The aim of her research is to design, create and evaluate autonomous moral artificial intelligence looking at moral theory and finding a way to successfully incorporate such theories into a machine.

1. Introduction

An agent can be considered autonomous if it is capable of acting on its own (Moharir et.al, 2019). Defining an agent as moral is slightly more complex, but generally, an agent can be considered moral if it is able to make decisions between right and wrong (Gert and Gert, 2017). Artificial Intelligence is the intelligence we ascribe to a machine in trying to make it more like a human (Turing, 2004). Therefore, the pursuit to create Autonomous Moral Artificial Intelligence (AMAI) can be defined as the pursuit to create a human-like machine that is able to make decisions between right and wrong.

Traditionally, moral capacity was an attribute ascribed only to humans. However, as machines become more autonomous, it has been argued that we should bestow upon machines the capacity to make their own moral decisions (Anderson and Anderson, 2007), (Vanderelst and Winfield, 2018). Although a field in its infancy, the pursuit to create AMAI is typically given the name machine ethics (Anderson and Anderson, 2007) and is receiving an increasing amount of attention (Anderson and Anderson, 2011; Awad et.al, 2018; Goodall, 2014).

The Trolley Problem is a philosophical dilemma that was initially introduced by Philippa Foot (1967) in order to highlight issues surrounding abortion. Although conceived as a hypothetical scenario, variations of The Trolley Problem are often used to highlight the need for AMAI.

Imagine you are driving down a busy high street. To your left is a woman with a pram (presumably with a baby inside it), to your right is a group of 5 teenagers. Suddenly, one of the teenagers is pushed into the road you are driving on. You are travelling at a considerable speed and are, therefore, unable to break before hitting the teenager. You are faced with a problem: 1) do you swerve to the left and potentially hit the woman and her baby? 2) Do you swerve to the right and hit the four teenagers? Or 3) do you keep going and hit the single teenager in the middle of the road? Which one is the right answer? If there is a right answer, how do we program a robot to behave the appropriate way?

The hope is that if we had autonomous vehicles in the situation described above, that they would be capable of making the right ethical decision. However, this argument rests upon the following assumptions: a) that the scenario above is realistic, b) that there is a right decision to take, c) that we want AMAI capable of solving this problem.

In the remainder of this paper, I explain why each of the following three assumptions are problematic. I then demonstrate how worrying about The Trolley Problem has led to problematic assumptions on how we should create AMAI and that this worry should stop. I finish by outlining what the real motivations for designing AMAI should be and explaining how The Trolley Problem can help us in this pursuit.

2. Analysing the Trolley Problem

Suppose that you are the driver of the vehicle in the described example. First, if you were responsibly driving the car and had identified that there was a woman with a pram to your left, and a group of potentially unpredictable teenagers to your right, you would adjust your speed accordingly. You wouldn't be driving at a speed that, should an unexpected incident occur, one of the pedestrians (or yourself) would be in any particular danger of being injured. In fact, it is possible that, upon looking down the road, you would have taken an alternative route. In reality, there might even be provisions in place preventing cars driving down high streets at busy periods. It is then reasonable to expect that an autonomous car, programmed with the capacity to detect movement, predict behaviour and drive according to traffic signs and regulation, would avoid such situation. Therefore, the scenario described above, although theoretically conceivable, would practically never occur in reality.

It might be argued that human behaviour is entirely unpredictable and that there could always be a situation where a pedestrian runs out into the line of movement of the autonomous vehicle, forcing it to make an ethical choice. But then again, this assumes that the vehicle won't be travelling at an appropriate speed based upon its environment and that it won't have the capacity to pre-empt such pedestrians running out into the road.

Therefore, assumption a) can be rejected, as the scenario is not practically realistic. The challenge moves from being a question of how we programme a machine to behave ethically to, instead, how we pragmatically programme a machine to react.

3. Moral Dilemmas

Even if we accept that the scenario described above is one that could possibly take place in reality, there is the contended issue that when we design AMAI, we are ultimately designing a machine that can make the right decision to a moral dilemma. Moral dilemmas are by their very nature difficult to resolve. McConnell (2018) describes a moral dilemma in the following way:

"The crucial features of a moral dilemma are these: the agent is required to do each of two (or more) actions; the agent can do each of the actions; but the agent cannot do both (or all) of the actions. The agent thus seems condemned to moral failure; no matter what she does, she will do something wrong (or fail to do something that she ought to do)."

The aim of moral dilemmas such as the trolley problem is not to pose a moral challenge to people engaged in the dilemma, but to highlight discrepancies in current assumptions about certain lines of moral thought. In the example posed in the introduction of this paper, it is not obvious that one of the three options would be the right choice to make, especially given other considerations such as:

» You don't fully know who was to blame for the incident

» You don't know the exact circumstances of the pedestrians involved: the teenager could later go on to cure cancer

» You can't predict the exact consequence of your decision

Furthermore, it does not automatically follow that making the right decision would be a criterion for being a moral agent. We can imagine somebody behaving a certain way in every moral dilemma they are presented with because they are following strict orders, but this person would not be regarded as moral in their decisions unless they had deliberated and made the choice themselves. This highlights that there is more to being moral than just doing the right thing, and that morality is as much about the process involved in making a decision as the outcome of the actions. Therefore, when creating AMAI, we should concentrate less on creating a machine that is right and more on replicating moral decision processes.

4. Designing Autonomous Moral Artificial Intelligence

Although machine ethics is a field in its infancy, there have been some practical approaches to designing AMAI. One notable attempt is by Vanderelst and Winfield (2018, p. 57) who describe the following approach:

"We aim at implementing consequentialist ethics, which is implicit in the very common conception of morality... Hence developing an architecture suited for this class of ethics"

Consequentialism is a philosophical theory which argues that we decide what is right and wrong based upon the consequences of an action (Sinnott-Armonstrong, 2019). Thus, the solution to The Trolley Problem would be whatever outcome has the best consequence. There are intrinsic problems with this approach: namely that, as highlighted in the previous section, the "best consequences" are not always obvious. Additionally, by focusing on the consequences of a scenario, you are drawn to the conclusion that The Trolley Problem can be solved.

By creating a cognitive decision architecture that is governed by a philosophical theory which acts as a solution to The Trolley Problem, Vanderelst and Winfield make the assumption that there are right ways for it to be approached. They later go on to say (p. 58):

"The behaviour enforced or prohibited by the Ethical Layer can be checked and (formally) verified."

The key assumption made here is that there are cases of ethical dilemmas where ethicists are in agreement as to what the correct action should be. However, as discussed in the previous section, this is often not the case. Therefore, designing an AMAI that makes this decision can only ever be viewed as contentious; there is not an absolute rule that a machine can follow. The approach taken by Vanderelst and Winfield (2018) is known as a 'top-down' approach. The stance is such that AMAI can be created by programming in a set of rules that guide behaviour. In the example by Vanderelst and Winfield, this corresponds to programming a decision process in that enables the machine to act according to consequentialist ethics. The approach that Vanderelst and Winfield take leads them to concede that their model is only applicable to context-specific situations, when, in reality, morality is not context specific.

Their 'top-down' approach can be contrasted to the 'bottom-up' approach within machine ethics (Wallach and Allen, 2008), which is the attempt to create AMAI that is capable of teaching itself how to behave. Although there are (yet) no explicit attempts to create this type of AMAI, a close design is that by Rolf and Crook (2016), which uses a model inspired by social interaction for the machine to learn appropriate moral behaviour. In this model, a machine interacts with its environment and learns appropriate behaviour by social ques given as a response, e.g. a smile might indicate that something 'good' was done.

In instances such as the Trolley Problem, a machine would learn the appropriate course of action by taking ques from its social 'guide'. If driving into the teenager made more people smile, then this would be the right course of action, which raises multiple problems in itself. First and foremost, just because somebody smiles, does not necessarily indicate that they did so in response to the action taken by the automated machine. Furthermore, a machine controlled just by a smile is very susceptible to being manipulated, and therefore controlled to act in ways to the guide's own benefit rather than to what is right. What is missing from this model is a component to ground the AMAI in the absolute correct course of action rather than what it is guided to believe.

A reliance on solving the trolley problem has created two approaches that are impractical and unable to accurately convey the definition set out in the introduction of what a moral being should be. This leads to the

final discussion, where a reassessment of how to deal with the Trolley Problem is presented in order to contribute more pragmatically to create AMAI.

5. Learning from the Trolley Problem

Reassessing our attitude towards The Trolley Problem is essential if solutions to creating AMAI are to be more accurately formulated. First, it is important to question what the true purpose of such moral dilemmas is. From my analysis, it is not to create a moral challenge for the ethicist to solve, but to highlight contradictions in moral thought processes. As a machine ethicist, the Trolley Problem does not need to be solved, but it should be analysed to properly understand what the requirements are for AMAI.

What we can learn from the Trolley Problem is that it is not finding a right decision to a moral dilemma what matters, but the underlying process of the agent making a decision in itself. Throughout this paper, I argue that this should be the focus when creating AMAI: reflecting on the decision process underlying observed moral actions.

6. Conclusion

Up until now it has been a key argument put forth by machine ethicists that as machines become ever more autonomous, situations such as The Trolley Problem cause the need to create AMAI. This rests on the following assumptions:

1. That The Trolley Problem is something that would occur in reality

2. That there is a right answer to The Trolley Problem

3. That AMAI's ultimate function should be to solve The Trolley Problem.

However, throughout the paper it has been demonstrated that assumption (1) is contentious due to the type of situations that autonomous vehicles might come across in reality; that assumption (2) is incorrect due to the complexity of moral situations; and that by focusing on assumption (3) we would be designing AMAI with a load of problems.

To conclude, when designing AMAI we should stop worrying about solving the Trolley Problem and instead embrace the moral decision making processes that arise from its analysis.

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