

Short Review of “Mapping the Landscape of Behavioural Theories: Systematic Literature Review”

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Abstract: The “behavioural” approach is receiving increasing attention in many disciplines, however, there is yet limited understanding of the available theories and how they can be applied. Through a cross-disciplinary literature review, this paper identifies 62 behavioural theories from 963 publications and classifies them into four groups: (1) those that explain the factors that affect behaviour such as the theory of planned behaviour and prospect theory, (2) those that focus on behaviour change strategies such as nudge theory, (3) those about learning and conditioning such as reinforcement learning theory, and (4) those that focus on the modelling such as neural networks theory and game theory. Based on the review, the paper discusses the lack of understanding of terms, classification, guidance on the use of appropriate theories, inclusion in data-driven research and modelling, and dialogue between theory-driven and data-driven approaches. Furthermore, it emphasizes the role of behavioural theories in bridging the divide between the traditional theory-based, aggregate, quantitative and equation-based approaches and the new data-based, disaggregate, qualitative and language-based approaches such as agent-based modelling. This conference paper is a shortened version of: Kwon, H.R. and Silva, E.A. (2019) Mapping the Landscape of Behavioural Theories: Systematic Literature Review, *Journal of Planning Literature*.

Keywords: behavioural theories; data-driven research; theory-driven research; agent-based modelling

Introduction

The term “behavioural” in the context of behavioural sciences has become fashionable in recent years as an innovative and alternative approach in many disciplines, including those closely related to planning. Along with this trend, many academics and practitioners have developed interest in applying various behavioural theories in their research: neural networks theory, reinforcement learning theory, game theory, the theory of planned behaviour, nudge theory and prospect theory to name a few. Understanding and applying behavioural theories can be greatly beneficial in many disciplines including urban and environmental planning because behavioural theories can take into account a variety of factors that affect people’s decision-making process and provide a framework to model, explain and predict behaviour which may enhance the effectiveness of policy design and behaviour intervention.

Although many of the theories about human behaviour have been in existence for some time, the concept of behaviour is so broad that it is difficult to figure out which theories can be considered behavioural theories across all fields of academic research. Some existing literature attempted to review and summarize behavioural theories, mostly focusing on behaviour change and intervention, for example, in the health sector (Michie *et al.*, 2005; Munro *et al.*, 2007; Davis *et al.*, 2015), environmental science (Morris *et al.*, 2012; Schlüter *et al.*, 2017) and transport (Savage *et al.*, 2011). While the UK Government Social Research (GSR) produced a behaviour change knowledge review for more general application by contacting key individual experts (Darnton, 2008, p.

75), there is not yet a publication that systematically reviews the academic journal database across all disciplines to provide a comprehensive landscape of behavioural theories. In addition, there is much more room to synthesizing how we conceptualize, model and formalize behavioural theories in the era of data-driven research and big data analytics in addition to guiding our understanding, selection and use of behavioural theories for particular uses.

To fill this gap, this paper takes a step forward from the existing literature by performing a systematic literature review using ‘all database’ in the Web of Science (WoS) to identify theories of general human behaviour across disciplines. At present, only a few popular behavioural theories are being applied in planning such as the theory of planned behaviour in transport (Castanier *et al.*, 2013) and prospect theory in housing and real estate (Dunning, 2017). By taking a general approach rather than zooming into the planning-related fields, this paper presents a comprehensive list and map of behavioural theories that have potential to be applied in planning.

This paper will first explain the methodology of the review and provide a conceptualization of the type of behaviour. Then, it will present a comprehensive list, classification and map of the 62 behavioural theories and analysis of the selected literature. Finally, discussions will be made about the implications for further research and the importance of behavioural theories in the era of big data analytics. The complete version in the *Journal of Planning Literature* provides tables, diagrams and in-depth analysis that are not discussed here in detail, and provides two appendices with further information regarding the key theories and publications (Kwon and Silva, 2019).

Methodology

There is an immense amount of literature on behavioural theories across disciplines: 96,700 publications on WoS all databases contain “behavio(u)ral theor(ies)” in topic from 1900 to 2017 (Web of Science, 2018). To filter the most significant and relevant papers.

First, from all database on Web of Science (WoS), we used the search keyword “behavio(u)ral theor(ies)” for title only and received 963 results in the time frame from 2000 to 2017. Second, we used different thresholds for times cited according to the year of publication and narrowed down the results to 467. We tried to include more recent publications to observe the current trend of research method while being stricter to older publications to only include the ones that were fairly recognized by other researchers. Third, we further narrowed down the publications to 156 by limiting the scope to general human behaviour in a general living environment, i.e. excluding non-human behaviour and specific behaviour such as patient behaviour regarding medication. Fourth, we listed 87 theories used in the 156 relevant results with the following information: founder, year of publication, number of WoS search results (2000-17) and search keywords used, top 5 research areas, top 3 publication years, and a short definition of theories based on the literature review (Appendix A: see Acknowledgements). Fifth, out of the 87 theories, only those with more than 10 WoS search results (2000-17) were kept, resulting in 62 theories. From the 156 publications, 47 that cover all 62 theories were chosen as key publications.

Classification and mapping of the selected behavioural theories

We conceptualized “behaviour” as a process where a stimulus (or situation) gets imposed on a person, he or she develops intention (or motivation), and this leads to a response (or decision) and decided to call a theory a “behavioural theory” if it explains some aspects of this response- or decision-making process. Then we classified the 62 theories into four groups based on their focus: 1) factors that affect intention (17 factors), 2) strategies that influence intention, 3) learning and conditioning that modify response, 4) and modeling of response.

The first group focuses on the factors that affect the process of decision-making. The theories from psychology tend to focus on more subjective and personal factors like attitude, subjective norm, psychological distance, fear appeal, beliefs and values, and heuristics while theories from sociology tend to focus on social interaction. On the other hand, the theories from economics, business, management, and finance tend to focus on more objective and non-personal factors like different interests, institutions, and rationality and utility. Also, some theories originate from one discipline but are mostly used in other disciplines, for example, behavioural economics is largely about applying psychological theories to economics such as prospect theory.

The second group focuses on the intervention strategies to influence the decision-making process and gets used largely in public policy to affect pro-environmental and pro-social behaviour such as nudge theory and behavioural spillover theory, and business management to affect consumer, employee, and business behaviour such as behavioural priming theory and diffusion of innovation theory. The third group concerns learning and conditioning theories from psychology that can modify the response which are largely applied in computer science lately for the topics of artificial intelligence and machine. Finally, the fourth group focuses on modeling the response-making and decision-making process, which includes more mathematical elements compared to other groups. Such theories about modeling get used in the areas of computer science and neuroscience the most for modeling techniques such as machine learning, agent-based modeling, dynamic network analysis and microsimulation. We included these theories as behavioural theories because, while they do not directly provide an explanation about how behaviour works, they help us model and understand the response- or decision-making process and are crucial theories that can link the behavioural approach with data-led research in the era of big data analytics.

Analysis of selected literature on behavioural theories

The list of 156 publications includes more of the recent publications possibly due to the selection threshold by times cited in the methodology. 87% of the literature are articles in a variety of journals while the rest are books or book chapters, in research areas mainly psychology, social sciences, computer science, environmental sciences, transportation, and engineering. 66% of the publications are available in full text online, free to many educational institutions. Also, 70% of the 156 publications were classified as empirical, i.e. using real world data and 30% as theoretical. Regarding the research method, most publications (97%) were identified to mainly use a quantitative approach, i.e. numbered data analyzed using statistical procedures, while only 3% mainly employed a qualitative approach although these two approaches are in a spectrum rather than being dichotomic.

As for the data collection methods, first-hand survey was the dominant method followed by interview, second-hand database, and simulation. Some innovative methods were observed, such as observation of investment decision-making behaviour through an online computer game, a survey using a web page with a user interface to collect carbon footprint report, and analysis of multi-object tracking behaviour by conducting simulation exercise on participants. With regard to the analysis method, regression was being used most frequently followed by correlation analysis, structural equation modeling and factor analysis and path analysis. As for the sample size, publications had 100 to 499 samples the most, followed by 500 to 20,000, less than 100, and big data such as 104 weeks of transaction screening through simulation with an ambiguous unit of data. Out of the 156 publications, the most frequently occurring theory was the theory of planned behaviour (in 33 publications) followed by prospect theory (in 11 publications). The summary of these 156 publications can be a useful guide to get an overview of how behavioural theories have been used in research since 2000 and what the current trends are (Appendix B: see Acknowledgements).

Discussion and conclusion

To better understand the landscape of behavioural theories, this paper performed a systematic literature review of 963 publications and identified 62 key theories. These theories were then classified into four groups (factors, strategies, learning and conditioning, and modeling) based on their focus and were mapped in a diagram with

the labeling of which research area the theories originate from. As a result, the literature review pointed to the following discussion points, which are the areas that require further research.

First, this paper's literature review suggests the lack of understanding of behavioural theories and behavioural sciences. The definition of "behavioural theory" is yet unclear that depending on how broad and narrow the definition and criteria are, some theories identified by this paper may not be considered behavioural theories and other theories outside this paper's list may be considered behavioural theories. Also, the understanding of what "behavioural sciences" entail is vague. A better clarification of the available theories and the fields involved is important to be able to transfer models and compare results.

Secondly, there is lack of classification of the type of behaviour and behavioural theories. Because different behaviour gets affected by different variables, classification of behavioural theories can help researchers identify which theories to use based on the purpose. While this paper attempts to classify the theories of general human behaviour across all disciplines in four groups, there is a lot of room for improvement, for example, identifying the hierarchy, family tree and overlapping concepts of theories.

Thirdly, there is a need to develop more guidance on the selection and use of appropriate behavioural theories. Lack of guidance often leads researchers, policymakers and practitioners to choose more common and well-known theories rather than the ones that may suit the target behaviour and population better and to only loosely refer to theories rather than using them rigorously. While the concepts of behavioural theory and behavioural science have an evolving nature with dynamic patterns within the debate, it will be greatly beneficial to have a table that shows a clear connection among the list of theories, key variables, the types of behaviour, and the social or environmental context that they are applicable to in the future with more in-depth analyses and comparative studies.

Fourth, behavioural theories can be more included in data-driven research and agent-based modelling. Computer science, artificial intelligence, and big data analytics are very important in the behavioural research at present, all part of the bigger effort towards the development of data science which is closely related to planning in the era of smart cities. The traditional theory-driven approach is largely linked with global equation-based modeling (EBM) while the new data-driven approach is closely linked with new language-based coding constructs such as agent-based modeling (ABM). Today, these approaches are gearing hybrid models (Wu and Silva 2010; Silva 2004; Wu and Silva 2013, Silva 2011) and such hybrid approach can suggest a new direction for the modeling of complex urban systems as part of the planning support science, for example, for the efforts to establish a "digital twin" of a city to aid planning-related decision-making. Behavioural theories can play a critical role in bridging the traditional theory-based, aggregate, quantitative and equation-based approaches with the new data-based, disaggregate, qualitative and language-based approaches such as agent-based modelling (Parunak, Savit, and Riolo, 1998; Ahmed and Klischewski, 2017).

Finally, behavioural theories are ever more important because they can answer "how and why", provide rationale for the rules, variables, assumptions and parameters of models, and help researchers generalize results (Wise and Shaffer, 2015). Furthermore, this paper proposes complexity theory as the overall theoretical concept (de Roo and Silva, 2010) and suggests that behavioural theories can play an important role in spatial planning in the bigger picture of integrating spatial and a-spatial approaches of modelling human behaviour.

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