The Role of Consumer Perception and Behaviour in the Transition towards the Circular Economy

Dimitris Georgantzis Garcia

A Thesis submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy

The University of Sheffield
Faculty of Social Sciences
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Abstract

The success of the transition to a circular economy is conditional upon consumers' adoption of sustainable consumption behaviours (SCB). Extant SCB research identifies the intentions-behaviour gap (IBG) as a significant problem in assessing progress in the transformation to sustainable consumption. That is, self-reported intentions fail to match observations of real SCB. The IBG poses a barrier to knowledge on SCB, and therefore also to progress towards a circular economy.

This Thesis elucidates theoretical and methodological solutions to the IBG capable of achieving more realistic results. An experiment rooted in the common pool resource framework is designed and conducted (N=295), enabling the observation of representative behaviour directly. Self-reported intentions with framings of varying ambiguity/abstraction are measured along other relevant psychometric, demographic and institutional factors. These include: dispositions toward sustainable consumption, psychological distance to climate change, risk aversion and gender. Institutional setting is operationalised through information quality (treatment), others' consumption and resource size. Structural equation and mixed effects modelling are employed in data analysis.

Findings suggest that intentions are a significant predictor of SCB only when unambiguously framed, and depending on institutional setting. Psychological factors are significant, but often conditionally to their interaction with others' consumption. Behavioural rebound effects arise for dispositions and psychological distance as low levels of others' consumption reverse their effect. The IBG worsens for females who only enact more SCB when reacting to others' behaviour, in contrast with recent self-report reliant findings.

Overall, the present research argues theoretically and empirically for the importance of concretely operationalising self-reported intentions to address the IBG. It also demonstrates the fragility of psychological- and demographic-behavioural effects when setting is accounted for. This Thesis contributes to circular economy research by offering a critical perspective on SCB and testing a new methodological approach for its appraisal.

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Declaration

I, the author, confirm that the Thesis is my own work. I am aware of the University's Guidance on the Use of Unfair Means (www.sheffield.ac.uk/ssid/unfair-means). This work has not been previously been presented for an award at this, or any other, university. Parts of Chapters 1 and 2 (Introduction and Literature Review) have been published by the Thesis author (Georgantzis Garcia et al. 2021). Parts of Chapter 4 (Methodology) are based around descriptions of the experiment that were first produced as part of a report written as a deliverable for the ReTraCE project (Realising the Transition Towards the Circular Economy) (Georgantzis Garcia et al., 2022).

CHAPTER 1: INTRODUCTION[1]

1.1 Motivation

Current consumption levels in affluent nations are unsustainable and account for an important share of the overall negative environmental impacts caused by human activity (Hertwich et al., 2010; United Nations Environmental Programme, 2013; United Nations Environmental Programme, 2019; European Environment Agency, 2020). Societal development is currently driven by a rhetoric of continuing economic growth, resulting in a system that requires the constant creation of new consumer needs that the market will subsequently address (Schmelzer, 2015). Consumer lifestyles and consumption patterns cannot change significantly enough to overcome this problem when they occur within a system of these characteristics (Thøgersen, 2014; European Environment Agency, 2020).

The Earth system is currently in transition from the Holocene to the Anthropocene. The former represents a stable state which is capable of sustaining human lives, while the latter is an uncertain state whose fate depends on the significance of human-economic shocks pushing Earth system away from its current Holocene-like state. Several planetary boundaries have been defined beyond which the Earth system enters a high uncertainty domain regarding its future and its ability to sustain human life (Rockström et al., 2009). As such, these boundaries define a safe operating space for humanity by minimising the likeliness of deviating from a Holocene-like state. The latest results on the state of planetary boundaries have shown that humanity is already operating outside the safe limits in at least four of the seven currently measurable boundaries (Steffen et al., 2015). The need to work towards a system of socio-economic development that operates within the Earth system's planetary boundaries is apparent and a priority for all spheres of society. This requires a system capable of facilitating the adoption of sustainable consumption patterns. As human-economic activity continues to push on the Earth system's (ES) boundaries, calls for a socio-economic development paradigm shift towards a sustainable one, are becoming increasingly urgent (Steffen et al., 2015). Therefore, it is not surprising that sustainable consumption and production have gained increasing attention among policymakers and international organisations, and academics alike (European Environment Agency, 2013; Steffan et al., 2015; Sauvé, Bernard and Sloan, 2016; United Nations Environmental Programme, 2019; European Environment Agency, 2020).

[1] Aspects of this chapter have been published by the Thesis author - see Georgantzis Garcia et al. (2021).

The unsustainability of human-economic activity in the Earth system, is a fact that calls for an urgent paradigm shift. The Circular Economy (CE) represents the latest attempt to enable this shift to accommodate human life on the planet sustainably (Murray, Skene and Haynes, 2017). The concept relies on a complex systems perspective to optimise the whole socio-economic system and not just its individual components, e.g. a whole supply chains vs. separate local processes, hence accounting for the interactions and synergies between its parts, with the goal of attaining sustainable development (Ellen MacArthur Foundation, 2013; Kirchherr, Reike and Hekkert, 2017). In particular, the CE proposes a re-thinking of the business models that drive our societies from all perspectives (e.g. regulatory context, consumer behaviour and supply chains), in order to enable more sustainable modes of production and consumption revolving around the nR (reduce, reuse, recycle…) framework. Material flows in a CE are such that biological nutrients are fed back to the biosphere safely, while technical nutrients are re-circulated maintaining their quality to maximise their use value to society, without entering the biosphere and becoming waste (Ellen MacArthur Foundation, 2013). The CE is currently being widely promoted by several nations, international bodies (e.g. China, Japan, UK, France, Netherlands, Spain) and businesses around the world (e.g. Danone and Patagonia) (Korhonen, Honkasalo and Seppälä, 2018). However, the CE's success depends on consumers' acceptance and involvement, making consumer behaviour particularly timely to understand in the context of CE (Henriques, Figueiredo and Nunes, 2023).

Alcalde-Calonge, Sáez-Martínez and Ruiz-Palomino (2022) conducted a bibliometric review, exploring the evolution of the CE concept in research from 2008 to 2020. Their review evidences the rapid growth of the concept (about 200x increase in articles within a decade) and identifies emerging trends within this period. Moreover, it offers a wide perspective on the themes and topics addressed in the literature and the attention they have been given in the literature within that period, relative one another. The most relevant keywords, besides CE itself were, *sustainability, management, life-cycle assessment, waste, performance, China, energy, design* and *recycling*. The importance of understanding the role and behaviour of consumers for the CE to succeed is also illustrated here by consumers' central involvement in some of the most significant keywords identified by the authors' network analysis, e.g. *recycling, recovery, remanufacturing,* and *reverse logistics* among others. However, as their network analysis shows, most of these rarely take a consumer perspective. In general, the portion of research that does take a consumer view within the 13 year period analysed by the authors is not proportional to the importance of

understanding consumers and their behaviour for the CE as a whole to succeed (Nguyen, Nguyen and Hoang, 2019; Alcalde-Calonge, Sáez-Martínez and Ruiz-Palomino, 2022).

In sum, consumption remains an under-researched topic both in the context of sustainability and the CE (Parajuly et al., 2020; Camacho-Otero, Boks and Pettersen, 2018). Consumer behaviour in the CE is of interest to all policymakers, academics, industry and civil society, especially given that these stakeholders are all equally embedded in both society and the environment, but is yet poorly understood (Henriques, Figueiredo and Nunes, 2023).

1.2 Research initiative

Partly due to its interdisciplinary nature, research on the CE is forming on the basis of several different analytical perspectives simultaneously, which are not always easy to marry, making it sparse and often confusing (Sauvé, Bernard and Sloan, 2016; Murray, Skene and Haynes, 2017). The CE concept is being currently promoted by nations, international bodies, and corporations and businesses around the world (Korhonen, Honkasalo and Seppälä, 2018). This inter-stakeholder and international diffusion is arguably the main factor differentiating it from other existing and extensively researched overlapping concepts such as industrial ecology (Saavedra et al., 2018). This makes it one of the concept's strongest attributes by incentivising its practical application and the generation of knowledge around it. However, it has also led to a lack of agreement regarding its definition and the emergence of perspectives with often competing objectives, making it an essentially contested concept (Korhonen et al., 2018). The challenging task of developing a definition capable of capturing all the characterising elements and goals of the CE has also contributed to said phenomenon (Kirchherr, Reike and Hekkert, 2017).

In general, the CE is characterised by initiatives for a better use of resources and waste management whose success often relies on acceptance and/or active engagement by consumers. Their behaviour and decision-making at purchase, use and end-of-life management stages of goods can enable or hinder the success of the CE's initiatives (Nguyen, Nguyen and Hoang, 2019; Parajuly et al., 2020). Moreover, sustainable consumption and production are necessary steps toward achieving the CE's goal of sustainable development. Therefore, sustainable consumption is one of the micro-level foundations of the CE (Kirchherr, Reike and Hekkert, 2017). Despite all the above, the consumption side has not been given nearly as much attention as the production side in the context of environmental sustainability (Parajuly et al., 2020). Similarly, external and

internal factors linked to consumers' habitual consumption and means by which to enable the success of a CE remain largely under-researched (Camacho-Otero, Boks and Pettersen, 2018).

The currently dominating free-market economic systems imply unsustainable consumption patterns and consumerist cultures, even when including green alternatives (Alcott, 2005; Akenji, 2014; Thøgersen, 2014). As a result, although useful, it is not sufficient to explore consumer preferences for sustainable alternatives of products/services (i.e. the quality of consumption). The quantity of consumption plays a crucial role in making consumption sustainable (Thøgersen, 2014). Hence, a deeper cultural shift capable of changing consumer lifestyles and consumption patterns such that they become sustainable (Vergragt, Akenji and Dewick, 2014; Reisch and Thøgersen, 2015). Despite that, the quantity of consumption and the factors behind it, such as culture and institutional context, are currently underexplored (Reisch and Thøgersen, 2015).

Additionally, previous efforts to understand sustainable consumer behaviour (SCB) tend to focus on the formation of behavioural intentions and attitudes that are then assumed to predict behaviour (Carrington, Neville and Whitwell, 2014; Larson and Farac, 2019; Elhoushy, 2020; Patel, Trivedi and Yagnik, 2020). Consequently, the scope of the conclusions to be drawn about behaviour from this stream of research is limited by a phenomenon known as the "attitude-behaviour gap" or "intentions-behaviour gap" (IBG) (Carrington, Neville and Whitwell, 2010). This refers to the widely reported misalignment between consumers' reported attitudes/intentions and their actual behaviour. For example, most Europeans report that they engage in waste management practices currently and are willing to engage with new business models (European Commission, 2018). However, these claims do not match observations of behaviour the real world (Parajuly et al., 2020). While commonly reported in ethical consumption contexts relevant to the CE, the IBG is still poorly understood (Carrington, Neville and Whitwell, 2014; Parajuly et al., 2020).

In sum, this research addresses the urgent need to understand consumption and, more specifically, the quantity of consumption within the context of sustainable development and CE. Moreover, by understanding the mechanisms behind the formation of the IBG it contributes to the elucidation of the main barriers that prevent even the "responsible consumer" from acting in coherence with their self-reported intentions or attitudes.

1.3 Research aim, objectives and approach

The present research aims **to contribute to academic knowledge on CE by enhancing understanding of consumer behaviour through an investigation of the factors that influence the formation of behavioural intentions, and their translation into action, in the context of a transition towards a CE**. Four research objectives (ROs) have been developed to address the aforementioned research aim (see Table 1). In turn, each objective will be addressed through subordinate research questions (RQs), as shown in Table 1. Naturally, each RQ receives contribution(s) from different sections of this Thesis and through different conceptual or empirical approaches. These individual contributions are presented in Table 1 and a short rationale for mapping them to their corresponding RQs follows:

(1.1) *What role is the consumer expected/required to play aiming for a successful transition towards a CE and how can this role be elicited?* - This is addressed through the literature review in Chapter 2, by conceptualising the CE in terms of its goals (Section 2.2) and focusing on implications for the consumer's role (Sections 2.2 and 2.3). The conceptual framework of Chapter 3 contributes to theoretical understanding of how the desired role can be most effectively elicited by overcoming shortcomings of current scientific understanding of the matter. In Chapters 5 and 6, these theoretical grounds are empirically assessed, hence contributing further to this research question.

(1.2) *How is consumption in the context of a CE to be conceptually understood and what is its role in the attainment of sustainable development?* – This is addressed primarily through the literature review, in Chapter 2, by first conceptualising consumption in the CE (Section 2.2), and then discussing its role relative to sustainable development (Sections 2.2 and 2.3).

(2.1) *How do consumers perceive the CE and associated behaviours as evidenced by their stated preferences?* – The literature review in Chapter 2, begins to address this question by conceptualising what CE-associated behaviours are (Section 2.2). Extant knowledge and important gaps, together with theoretical explanations that rely on individuals' perceptions are provided in Sections 2.2 and 2.3 respectively. By discussing how relevant behaviours can be observed/measured, Section 2.6, further contributes to understanding perceptual elements of CE-related behaviours. The conceptual framework (Chapter 3) and empirical analyses (Chapters 5 and 6), all contribute to this research question by laying down a conceptual foundation for understanding the intentions-behaviour relationship in terms of individuals' perceptions, and empirically assessing it.

Research Objectives	Research Questions	Addressed through…
RO1: To identify the role of consumers in the transition towards the CE and sustainable development.	**(1.1)** What role is the consumer expected/required to play in achieving a successful transition towards a CE and how can this role be elicited?	Literature review (Chapter 2), conceptual framework (Chapter 3), and empirical analyses (Chapters 5 and 6).
	(1.2) How is consumption in the context of a CE to be conceptually understood and what is its role in the attainment of sustainable development?	Literature review (Chapter 2).
RO2: To identify how consumers perceive the CE, by focusing on their stated preferences and behaviour.	**(2.1)** How do consumers perceive the CE and associated behaviours as evidenced by their stated preferences?	Literature review (Chapter 2), conceptual framework (Chapter 3) and empirical analyses (Chapters 5 and 6)
	(2.2) What role does consumers' perception play in their adoption of sustainable consumer behaviour?	Literature review (Chapter 2), methodology (Chapter 4), conceptual framework (Chapter 3) and empirical analyses (Chapters 5 and 6)
RO3: To identify the mechanisms that influence the translation of consumers' intentions into actual CE-oriented behaviour.	**(3.1)** What consumer behaviours characterise the CE and how have they been conceptualised in existing literature?	Literature review (Chapter 2).
	(3.2) What are the most prominent theories and conceptual models used to understand CE-oriented behaviour currently?	Literature review (Chapter 2) and conceptual framework (Chapter 3).
	(3.3) What are the internal and external factors that determine the formation of the consumer's intentions to behave sustainably and their consequent translation into action?	Literature review (Chapter 2), conceptual framework (Chapter 3), methodology (Chapter 4) and empirical analyses (Chapters 5 and 6).
	(3.4) How do these factors interact to drive or hinder the formation of CE-oriented behavioural intentions and their translation into action?	Literature review (Chapter 2), conceptual framework (Chapter 3) and empirical analyses (Chapters 5 and 6)
RO4: To provide recommendations and insight toward the development of the right institutional context (regulative and normative) in order to fill current gaps in consumers' adoption of CE practices.	**(4.1)** *Given the factors and mechanisms identified for RO3*, **(3.1)** Which of the identified factors can be externally perturbed in order to drive sustainable consumer behaviour and to close the current gap in the adoption of CE-practices?	Conceptual framework (3) and empirical analyses (Chapters 5 and 6).
	(4.2) Therefore, what strategies, targeting the identified factors, can be employed to drive the adoption of CE-initiatives?	Lit. review (Chapter 2), conceptual framework (Chapter 3) and empirical analyses (Chapters 5 and 6)

Table 1. Research objectives and questions shown with their individual sources of contribution within this Thesis.

(2.2) *What role does consumers' perception play in their adoption of sustainable consumer behaviour?* – The literature review offers a starting point in this research question, by analysing what the sustainable consumption practices are conceptually, based on extant knowledge (Section 2.2). Section 2.4 contributes to this RQ through an institutional theory perspective which enables considerations of macro outcomes of micro perceptions and strategies, and their potential to drive sustainability. Sections 2.3 and 2.4 offer further contribution by highlighting the importance of perception, not only in practice, but in research, i.e. theory and measurement. The conceptual framework (Chapter 3), methodology (Chapter 4) contribute to this RQ by laying down the theoretical and methodological grounds on which to empirically understand the role of consumers' perceptions (Chapters 5 and 6).

(3.1) *What consumer behaviours characterise the CE and how have they been conceptualised in existing literature?* – This research question is addressed directly in the literature review chapter, Chapter 2 (Section 2.2), which deals partly with the conceptualisation of behaviour for the CE, and relating this to extant behavioural constructs.

(3.2) *What are the most prominent theories and conceptual models used to understand CE-oriented behaviour currently?* – The literature review, Chapter 2, offers some insight into the dominating conceptual framework surrounding CE-relevant behaviour based around the intentions-behaviour relationship. Then the focus is turned to understanding the intentions-behaviour gap (IBG) and important theories are discussed, offering further contribution to this RQ. In Chapter 3, by building a conceptual framework based on extant theory, this RQ is further addressed.

(3.3) *What are the internal and external factors that determine the formation of the consumer's intentions to behave sustainably and their consequent translation into action?* – Addressing this RQ starts from the literature review, Chapter 2. Here, extant knowledge on the intentions-behaviour relationship, and most importantly the IBG, are synthesised through critical review. Then the conceptual framework (Chapter 3) contributes to extending this knowledge empirically, through innovation in both theory and methodology (the latter refers to Chapter 4). Finally, Chapters 5 and 6 complete the efforts toward this RQ by empirically assessing the

hypotheses stemming from the conceptual framework, shedding light on important factors behind intention formation and behavioural outcomes.

(3.4) *How do these factors interact to drive or hinder the formation of CE-oriented behavioural intentions and their translation into action?* – Through the conceptual framework developed in Chapter 3, hypotheses are constructed from theory around the processes by which certain important factors interact to influence the intentions-behaviour relationship. The methodology, presented in Chapter 4, enables the comparison of psychological effects when institutional setting is taken as given, with the explicit consideration of setting, hence contributing to this RQ further. Finally, Chapters 5 and 6 contribute to this RQ by instrumentalising the methodology and applying it to the exploration of the interaction of psychological and demographic factors amongst each other, and with elements of institutional setting, leading to observed behavioural outcomes.

(4.1) *Given the factors and mechanisms identified for RO3,* ***(3.1)*** *Which of the identified factors can be externally perturbed in order to drive sustainable consumer behaviour and to close the current gap in the adoption of CE-practices? AND* **(4.2)** *Therefore, what strategies, targeting the identified factors, can be employed to drive the adoption of CE-initiatives?* – These questions are addressed by laying down a conceptual framework, in Chapter 3, which allows for subsequent empirical analysis carried out in Chapters 5 and 6, in a complementary manner. Through these analyses, not only are factors behind behavioural adoption empirically assessed for their relative significance, but typical methodological drawbacks are addressed, which can contribute to more realistic conclusions in research. Therefore, there are recommendations to be drawn for both, driving more sustainable behaviours, and conducting research on sustainable consumer behaviour.

Chapter 7 also contributes to all research questions by putting findings into perspective, highlighting its contributions, discussing limitations and offering practical recommendations. In particular, it can be thought to contribute primarily to RQs 4.1 and 4.2 since it is concerned with stating recommendations. However, all the materials that are synthesised in the Chapter 7 draw from conceptualisation and analyses from previous chapters.

1.4 Research parameters and approach

The unit of analysis in this research is the individual consumer, specifically in the context of a CE. Consumer psychology, gender and institutional setting surrounding behaviour play a central role.

However, it is their influence on individual behaviour that lies at the centre of the analyses conducted.

A critical realist stance is adopted. In doing so, the benefits of both positivist and interpretivist standpoints are acknowledged (Saunders, Lewis, and Thornhill, 2019). The former elicits an epistemology that strives for objectivity and the discovery of general objective mechanisms and relationships that are not dependent on one's interpretation. While an interpretivist point of view offers epistemological value to subjectivity and interpretation (Basias and Pollalis, 2018; Irshaidat, 2022). Both these views are important when approaching practical social problems such as sustainability, where politics, businesses, science, and public opinion often have clashing interests, which can lead to biased interpretations of statistics and data (Roth and Mehta, 2002; Mukumbang, 2023).

Striving for epistemological objectivity, which is characteristic of a positivist standpoint, supports generalisability of results (Carminati, 2018). This is desirable since policy instruments and institutional contexts used to achieve societal goals are shared by the general public regionally, nationally, internationally etc. (Mukumbang, 2023). Therefore, these should be based on knowledge that is constructed on the basis of generalisability of results.

On the other hand, valuing and highlighting subjectivity, typical of an interpretivist stance, draws attention away from generalisability and favours critical in-depth perspectives (Carminati, 2018). This helps understand the caveats of extant knowledge to avoid perpetuating reductionist interpretations of scientific data which are often unrealistic (Mukumbang, 2023). Practically, the benefits of adopting a critical realist stance often materialise through the application of quantitative and qualitative methods combined, i.e. mixed methods approach (Almalki, 2016; Mukumbang, 2023). In this Thesis, theory is built primarily qualitatively by critically reviewing the literature. Then, testable hypotheses and propositions are laid out to be empirically tested quantitatively, while at the same time aiming to extend theory by empirical observation. In sum, this describes a mixed methods approach since it uses qualitative critical analysis, followed by quantitative-statistical analysis (Mukumbang, 2023).

A quantitative experiment and survey methodologies were combined aiming to uncover the origins of the intentions-behaviour gap (IBG), an important limitation affecting knowledge on sustainable consumer behaviour (SCB) currently, and ways to overcome it. The experiment allows for observation of actual behaviour and institutional setting dynamics directly, while the survey part allows for implementation of rigorous methods of psychometric measurement. In

combination, they provide a basis for the comparison of results with extant research and under different assumptions about institutional setting.

The literature review, being critical, employs a narrative and conceptual approach to uncover important shortcomings in sustainable consumer behaviour research which are commonly overlooked. The literature review also combines a systematic search on the topic of the IBG, while maintaining its narrative-conceptual approach to analysis of the identified sources. The latter helps avoid just perpetuating what has already been said and uncover shortcomings in extant knowledge that may otherwise be overlooked (Grant and Booth, 2009).

Experimental and survey data are analysed together by means of approaches drawn from psychometrics/marketing and econometrics. The first analysis, which employs structural equation modelling, takes institutional setting as given and behaviour as a time-aggregate, and focuses on psychological factors and their interplay with, and around, the intentions-behaviour relationship. Then, the influence of institutional setting is introduced in a second study which uses a linear mixed model to observe individual behaviour more locally.

This Thesis is structured as follows: Chapter 2 reviews the literature and lays down theoretical foundations on which the Thesis later on builds. In Chapter 3 the conceptual framework is elaborated serving as the theoretical basis for the construction of testable hypotheses. Chapter 4 offers a detailed account of the methodology and methods employed, including construct operationalisation and data collection. Chapter 5 focuses on the first statistical analysis of the data which employs structural equation modelling to test several of the theoretical hypotheses previously developed. Similarly, Chapter 6 extends the analysis of Chapter 5 by means of a mixed effects model, which accounts for the influence of institutional setting on the relationships uncovered previously in Chapter 5. Finally, Chapter 7 offers a discussion which synthesises the findings of this Thesis and discusses them relative to existing and further research, limitations, and recommendations for policy and management.

CHAPTER 2: LITERATURE REVIEW AND THEORETICAL FOUNDATIONS[2]

2.1 Introduction

This chapter offers a review of the literature on circular economy (CE), employing a consumer behavioural focus, and lays down the theoretical foundations on which further conceptualisation and analysis conducted in this Thesis rests.

Extant research has made efforts to understand attitudinal factors and mechanisms behind consumers' preference for products differentiated through their reported circular attributes (Testa, Sarti and Frey, 2019). However, a sound conceptualisation of the meaning of the CE for consumers, beyond the purchase of alternative products marketed as greener options, is missing from the literature (Henriques, Figueiredo and Nunes, 2023). As a result, factors such as consumers' habitual consumption and consumption culture, and means for enabling the success of a CE by focusing on its goals remain poorly understood (Camacho-Otero, Boks and Pettersen, 2018; Parajuly et al., 2020; Gomes and Lopes, 2023; Luukkonen, Närvänen and Becker, 2024).

Camacho-Otero, Boks and Pettersen (2018) begin to address this conceptualisation by offering a synthesis of research on consumption in the CE by means of a systematic literature review. The literature review presented in this chapter builds on Camacho-Otero, Boks and Pettersen's (2018) efforts by providing an extended critical review of the CE literature and developing a conceptualisation of consumption in the CE that respects the concept's definition. Moreover, this is contrasted against related streams examining sustainable consumption broadly, such as ethical and pro-environmental consumption. Then, several commonly overlooked shortcomings are covered, that can limit the utility of further research assuming a direct transfer from extant concepts, methods, and knowledge to CE-focused studies. These findings serve as the basis for the empirical inquiry conducted as part of this Thesis. A summary of the key themes covered in the review, broken down into main topics and subsequent key points, together with their location within the review and the key references corresponding to each point, is presented in Table 2.

[2] Aspects of this chapter have been published by the Thesis author - see Georgantzis Garcia et al. (2021).

Theme	Topics	Key Points/Gaps	Sec.	Key references
Characterisation of consumption	Pillars of consumption in the Circular Economy	-(1) Hierarchy of circular strategies (i.e., preference for the reduce strategy), (2) inadequacy of defining CE-consumption without regard for its goals.	2.2	(Singh and Ordoñez, 2016; Kirchherr, Reike and Hekkert, 2017; Korhonen et al., 2018; Camacho-Otero, Boks and Pettersen, 2018; Zero Waste International Alliance, 2021)
	Overlaps and fundamental differences with extant concepts	-Focus on consumption drivers (i.e., sustainable, ethical, responsible, green and pro-environmental consumption) vs. Product-as-Service Systems, collaborative consumption or stakeholder involvement.		(United Nations Environmental Programme, 2001; Thøgersen and Ölander, 2003; De Pelsmacker et al., 2005; Peattie, 2010; Reczek and Irwin, 2015; Liedtke et al., 2015; Barbarossa and De Pelsmacker, 2016; see Catulli, Cook and Potter, 2017; Park and Armstrong, 2017; White, Habib and Hardisty, 2019)
The reduce strategy in consumption	Population, affluence and technology as determinants of global sustainability	-The importance of considerations of sufficiency (quantity of consumption) vs. green consumerism (quality of consumption), currently underrepresented by the literature.	2.2	(Ehrlich and Holdren, 1971; Daly and Cobb, 1989; Ewen, 1996; Dasgupta, 2001; Inglehart and Klingemann, 2003; Alcott, 2005; Princen, 2005; Mulder, Costanza and Erickson, 2006; Pimentel, 2006; Abdallah et al., 2009; Herring and Sorrell, 2009; Jackson, 2009; Rockström et al., 2009; Assadourian, Starke and Mastny, 2010; Botsman and Rogers, 2010; Wilkinson and Pickett, 2011; Clugston, 2012; Bruhn and Lowrey, 2012; Vergragt, 2013; Akenji, 2014; Thøgersen, 2014; Vergragt, Akenji and Dewick, 2014; Reisch and Thøgersen, 2015; Steffen et al., 2015; Brown and Vergragt, 2016; European Environment Agency, 2020; Millward-Hopkins et al., 2020; Kara et al., 2022)
	A neo-institutional perspective on the sustainability of consumption	-A combination of bottom-up and top-down strategies necessary for a successful transition towards sustainable development. Shared citizen–government responsibility.		(Meyer and Rowan, 1977; Zucker, 1987; Boulding, 1991; Strang and Meyer, 1993; Elgin, 1993; Ölander and Thøgersen, 1995; Suchman, 1995; Gilbert, Fiske and Lindzey, 1998; Cabinet Office, 1999; Bullock, Mountford and Stanley, 2001 Fresco and Meadows, 2002; Doherty and Etzioni, 2003; Jackson, 2005; Lounsbury, 2007; Frank, 2008; Scott, 2008; Jackson, 2009; Hamilton, 2010; Wells and Foxall, 2012; Chaney and Slimane, 2014; Vergragt, Akenji and Dewick, 2014; Mont, Neuvonen and Lähteenoja, 2014; Young and Zamir, 2014; Reisch and Thøgersen, 2015; Tukker et al., 2017; Haugtvedt, Herr and Kardes, 2018; Straßheim and Beck, 2018; Transition Network, 2023)
The intention–behaviour gap (IBG) in sustainable consumption	Self-report measures of sustainable consumer behaviour (i.e., methodologist perspective on the IBG)	-Employing considerations of pro-environmental consumption tendencies, diary procedures or impact-based measures. -Need for innovation in data-collection methods where behaviour is observed, not self reported. This requires *incentive compatibility*.	2.3	(Cummings, 1997; Schwarz, 1999; Carrigan and Attalla, 2001; Ajzen, Brown and Carvajal, 2004; Murphy et al., 2005; Auger and Devinney, 2007; Carson and Groves, 2007; Davies, Lee and Ahonkhai, 2012; Araña and León, 2013; Carrington, Neville and Whitwell, 2014; Campbell et al., 2015; Fuller, 2016; Loy et al., 2016; Shaw, McMaster and Newholm, 2016; Zawojska and Czajkowski, 2017; Frank, 2018; Frank and Brock, 2018; Govind et al., 2019; Zeng and Durif, 2019; Hackethal et al., 2023)

Theme	Topics	Key Points/Gaps	Sec.	Key references
	Theory of Planned Behaviour widely favoured (i.e., modeller perspective on the IBG)	-Research tends to focus on the formation of behavioural intentions under the assumption that they will strongly predict behaviour. -Need for innovation regarding the conceptual models employed and empirical testing of extant conceptualisations.		Belk, 1975; Ajzen and Madden, 1986; Gollwitzer, 1999; Chatzidakis, Hibbert and Smith, 2007; Szmigin, Carrigan and McEachern, 2009; Carrington, Neville and Whitwell, 2010; Giacomantonio et al., 2010; Trope and Liberman, 2010; Davies, Lee and Ahonkhai, 2012; Gregory-Smith, Smith and Winklhofer, 2013; Baltatescu, 2014; McDonald et al., 2015; Shaw, McMaster and Newholm, 2016; Grimmer and Miles, 2017; Frank, 2018; Frank and Brock, 2018; Torma, Aschemann-Witzel and Thøgersen, 2018; Wiederhold and Martinez, 2018; Frank and Brock, 2019; De Lanauze and Siadou-Martin, 2019; Foti and Devine, 2019; Nguyen, Nguyen and Hoang, 2019; Wang et al., 2019)
Measurement of sustainable behaviour	Self-reports: dispositional, diary-based and impact-based instruments	-Diary procedures and impact based measures are promising avenues to minimise the prominence of the IBG when using self-reports. -Not well tailored to studying the IBG, despite the potential of some approaches to minimise its negative consequences.	2.4	(Galli et al., 2007; Kitzes et al., 2009; Hepburn, 2010; Maleetipwan-Mattsson, Laike and Johansson, 2013; Newcomb and Mustanski, 2014; Bleys et al., 2018; Lange and Dewitte, 2019; Global Footprint Network, 2023)
	Social dilemmas, common pool resource games and laboratory experiments in economics	-Sustainable behaviour is subject to the commons dilemma since resource extraction through consumption describes a commons scenario. -Common pool resource games have long been used to design laboratory experiments in economics meeting incentive compatibility criteria, where behaviour is observed – not self-reported.		(Hardin, 1968; Liebrand, 1983; Gardner, Ostrom and Walker, 1990; Ostrom, Walker and Gardner, 1994; Fischer, Irlenbusch and Sadrieh, 2004; Camargo and Haydu, 2016; Georgantzis Garcia et al., 2021; Tisserand et al., 2022; Herne, Kuyper and Lappalainen, 2023)

Table 2. Review summary table. This table provides a summary of key points and gaps identified in the review together with key references organised into their respective sections.

The section that follows (Section 2.2) offers a discussion on the definition of the CE extracting core elements for understanding the role of consumption. Additionally, in Section 2.2 the extracted concepts are reviewed against existing literatures that study pertinent consumption behaviours. Section 2.3 seeks to illustrate the current unsustainability of human-originated perturbations of the Earth system. In response, an institutional theory perspective is adopted (Section 2.4) to highlight the importance of combining bottom-up and top-down CE-enabling initiatives is stressed. Together, these considerations lead to an argument for the importance of the reduce strategy, included in the definition of the CE, and its relation to the concept of sufficiency. Section 2.5 offers a review of the literature pertinent to the IBG and the CE and key weaknesses are identified. Section 2.6 briefly outlines existing approaches to measuring sustainable consumption behaviour (SCB) through self-reports, highlighting the particularly relevant nature of impact-based measures of behaviour and diary procedures. The section concludes by introducing the context of social dilemmas and the tragedy of the commons in the context of using laboratory experiments for the measurement of SCB (Hardin, 1968). Finally, Section 2.7 offers a summary and discussion of the key points and findings of the review and its main contributions to the literature. The section concludes by providing a discussion of the main managerial implications, limitations of this review and avenues for further research. It is worth noting that in the Methodology chapter (Chapter 4), Section 4.2 reports on the methods employed in the literature identification stage of the present review, as well as the reasoning behind the choice of a qualitative, critical approach to the analysis of the sources (Section 4.3).

2.2 Defining consumption in the Circular Economy

The diffusion of the CE concept into numerous research disciplines and the interest it has sparked in academia, businesses and governments alike, is arguably one of the main factors differentiating it from previous attempts moving towards similar directions, like industrial ecology (Korhonen, Honkasalo and Seppälä, 2018; Saavedra et al., 2018). In fact, this can be understood as its main strength as it significantly increases the probability of its successful practical implementation (Korhonen et al., 2018). However, as explained in Section 1.2, this interest for the CE shared among actors and disciplines has also led to many different understandings of the concept, making perspectives sparse and often incompatible from one another (Sauvé, Bernard and Sloan, 2016; Murray, Skene and Haynes, 2017). A direct consequence

of these differing views is the emergence of an overwhelming number of different definitions of the CE in the academic literature (Kirchherr, Reike and Hekkert, 2017).

Kirchherr, Reike and Hekkert (2017) draw from 114 definitions of the CE in order to identify essential elements that characterise the CE. They then develop the following definition, which is the one adopted by the present review and Thesis, by combining all characterising elements of the CE: "*A Circular Economy describes an economic system that is based on business models which replace the "end-of-life" concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes, thus operating at the micro level (products, companies, consumers), meso level (eco-industrial parks) and macro level (city, region, nation and beyond), with the aim to accomplish sustainable development, which implies creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations*" (p. 224-225). This definition was strategically put together by Kirchherr, Reike and Hekkert (2017) in order to capture the most critical characterising elements stemming from the 114 extant definitions that their work reviewed. In particular, two elements are especially relevant to considerations about consumption:

1. **The hierarchical nature of strategies for circularity:** The order of the R-strategies in the definition is not arbitrary. Instead, strategies appearing first are preferred, by definition, to those that come up later in the definition (Kirchherr, Reike and Hekkert, 2017). According to the definition for instance, reducing should be prioritised and other higher entropy solutions like reusing or recycling should be employed only provided the reduce strategy is not possible or sufficient. This conception is also highlighted by Europe's waste-management hierarchy (Singh and Ordoñez, 2016; Camacho-Otero, Boks and Pettersen, 2018) and movements like the Zero Waste International Alliance who aim to boost the adoption of waste management strategies in line with the CE through education, recommendations for policy and benchmarking (Zero Waste International Alliance, 2021)
2. **The accomplishment of sustainable development is the goal of the CE:** It does not suffice to define the CE and its processes in terms of "means", it is necessary to also acknowledge its "ends" (Kirchherr, Reike and Hekkert, 2017; Korhonen et al., 2018). Therefore, considerations of consumer behaviour in the CE cannot disregard potential externalities of said behaviours and practices on the basis of operational circularity only.

It is important at this point to understand the meaning of "(un)sustainable development". The term encompasses socio-economic development that can (or cannot) be sustained over time

and space. A system may be very effective in driving societal development. However, if it cannot be sustained, there is a limit to how long the system can operate for, resulting in the system's unsuitability as a strategy for the attainment of long-term or world-wide societal development. Hence, it does not suffice to have a good economic system if it is not also sustainable. Current socio-economic systems require resource extraction and imply technological and other processes, all of which put pressure on the Earth system. Within this line of thought, as illustrated in Section 1.1, the current paradigm of socio-economic development is not sustainable (Rockström et al., 2009; Steffen et al., 2015). Consequently, important efforts such as the Sustainable Development Goals of the United Nations have emerged, aiming to address the key flaws of the socio-economic system with respect to its lack of sustainability (Gunawan, Permatasari and Tilt, 2020).

As Peattie (2010) explains, consumption behaviours that aim to achieve sustainable development reflect the United Nations Environmental Program's (2001) notion of sustainable consumption (see Table 4). Based on the above-mentioned definition of the CE, sustainable consumption constitutes part of the micro-level basis on which underpins the CE paradigm. Therefore, a successful transition towards a CE requires a change of consumption patterns such that they become increasingly sustainable (i.e., in coherence with sustainable development). Although the CE may be considered a new paradigm, the consumption behaviours it entails (i.e., sustainable consumer behaviour) have been researched as a broader phenomenon to a reasonable extent. Moreover, the concepts of "ethical consumer behaviour", "green consumption", "responsible consumer behaviour" and "pro-environmental consumer behaviour" overlap significantly with that of sustainable consumer behaviour (SCB). This creates ambiguity and a lack of consistency regarding their conceptions in the literature (Peattie, 2010). Table 4 presents an illustration of the inconsistencies in the defining foci of these concepts. A more detailed discussion on these follows.

In the case of sustainable consumption (or SCB), insights 1 and 2 (I1 and I2 in Table 4) offer two definitions of the concept drawn from two different sources. In the first (I1), a clear preference in focus is given to the environmental dimension of sustainability: "actions that result in decreases in adverse environmental impacts [...] decreased utilisation of natural resources..." (White, Habib and Hardisty, 2019)(p. 24). As shown in the table, the authors go on to justify this preference by arguing that the dimensions of sustainability are in fact non-orthogonal (i.e., they depend on one another) and that the environmental dimension has significant potential to

improve the other two (White, Habib and Hardisty, 2019). On the other hand, the second definition (I2) quite clearly addresses all three dimensions of sustainability equally: "enhancing quality of life"; "continually reducing environmental damage"; "meeting needs [...] for both current and future generations" (United Nations Environmental Programme, 2001). This definition also highlights the future-looking perspective of sustainability, which is not explicitly addressed by White, Habib and Hardisty (2019), further illustrating their differences.

Concept	Insight 1 (I1)	Insight 2 (I2)
Sustainable consumer behaviour (SCB)	"actions that result in decreases in adverse environmental impacts as well as decreased utilisation of natural resources across the lifecycle of the product, behaviour, or service. […] improving environmental sustainability can result in both social and economic advances" (White, Habib and Hardisty, 2019)(p. 24)	"a number of key issues, such as meeting needs, enhancing quality of life, improving efficiency, minimizing waste, taking a life cycle perspective and taking into account the equity dimension, for both current and future generations, while continually reducing environmental damage and the risk to human health" (United Nations Environmental Programme, 2001)
Green consumer behaviour	"as shorthand for oriented toward sustainable development. This reflects the United Nations Environment Program's conception of sustainable consumption" (Peattie, 2010)(p. 197)	Green consumers defined "as those individuals who engage in a set of pro-environmental behaviours (e.g., recycling, reducing household waste) primarily for environmental reasons" (Barbarossa and De Pelsmacker, 2016)(p. 230)
Ethical consumer behaviour	"consumption activities that are consistent with conscience, values, and morals" (Reczek and Irwin, 2015) (p. 507)	"the purchase of a product that concerns a certain ethical issue and that a consumer chooses freely" (De Pelsmacker et al., 2005) (p. 512)
Responsible consumer behaviour	"in 2015, the United Nations introduced a new series of goals called 'Sustainable Development Goals' (SDGs) made up of 17 goals and 169 associated targets to be achieved over the next 15-year period starting from 2016 until 2030." (Gunawan, Permatasari and Tilt, 2020) (p. 2) "Responsible Consumption and Production is the twelfth SDG goal." (Gunawan, Permatasari and Tilt, 2020) (p. 6)	This is also given the alternative name "Goal 12: Ensure sustainable consumption and production patterns" in official UN documents. In other words, the concepts of "responsible" and "sustainable" consumption are understood to have the exact same meaning.

Table 3. Consumption in the Circular Economy (CE): Relevant already existing concepts.

For green consumption (second row of Table 4), I1 provides a definition which the author arrives at following an insightful discussion on the lack of consensus regarding the definitions of these concepts: "as shorthand for oriented toward sustainable development" (Peattie, 2010) (p. 197). This definition essentially results in the use of "green" to mean "sustainable", clearly illustrating the overlap. On the other hand, I2 provides a definition of "green consumers" that

focuses on the pro-environmental nature of the behaviours, “individuals who engage in a set of pro-environmental behaviours” and the reasons for their action, “primarily for environmental reasons” (Barbarossa and De Pelsmacker, 2016) (p. 230). Therefore, the focus could be understood as more environmental than social or economic, in which case, these two conceptions of green consumption lack coherence. However, the meaning of pro-environmental consumer behaviour, has been shifting towards that of SCB in recent years (Takase, Kondo and Washizu, 2005; Van Nes and Cramer, 2006; Steg and Vlek, 2009; Peattie, 2010; Shin et al., 2018). If this was to be taken into account in the comparison of I1 and I2, then the overlap between “green” and “sustainable” becomes even more clear.

At this point, it is worth mentioning that I2 for green consumption (Table 4) is in line with the notion of “spillover effects” (Thøgersen and Ölander, 2003), whereby a consumer’s pro-environmental consumer behaviour in one setting can spill over to other settings when the reason for behaving sustainably is mostly environmental. However, a common alternative definition does not require that the behaviour takes place for environmental reasons. This results in a lack of coherence in marketing literature aiming to profile the green consumer, which is one of its main aims (Larson and Farac, 2019).

For the concept of ethical consumption, I1 and I2 on Table 4 provide two different definitions whose foci are rather inconsistent. The former provides a perspective that is concerned with general concepts of ethics and does not specify a single type of behaviour, instead it talks about “consumption activities” (Reczek and Irwin, 2015)(p. 507) in general. On the other hand, the latter does specify that the behaviour of interest is “the purchase of a product” (De Pelsmacker et al., 2005)(p. 512) and further requires that the purchasing decision is made by the consumer “freely” (De Pelsmacker et al., 2005)(p. 512). These insights, therefore, exhibit incoherence in their foci which results in confusion and difficulties in integrating conclusions from different studies. The final point that the present comparison aims to illustrate is the overlap between ethical consumption with sustainable and green consumption. In particular, given that sustainability constitutes a major ethical issue (Doane, 2001), sustainable (and green) consumption can be understood as a subset of ethical consumption, since I2 defines ethical consumption as purchasing behaviour “that concerns a certain ethical issue” (De Pelsmacker et al., 2005)(p. 512), making the overlap apparent.

The fourth and final row of Table 4 shows how the terms “responsible” and “sustainable” consumption are used interchangeably, by the United Nations, to mean the same thing. This is

illustrated by the 12th SDG goal having the title of “Responsible consumption and production” (Gunawan, Permatasari and Tilt, 2020)(p. 6) as well as the alternative one “Sustainable consumption and production”. In conclusion, all the research streams discussed throughout this section are potentially useful for one another. Their constituent pieces of research often study specific consumption behaviours that can be (correctly) considered ethical, responsible, pro-environmental, green or sustainable, and are often just tagged differently from one study to the next.

As explained earlier in this section (2.2), in order to achieve an implementation of CE that respects its formal definition, SCB is a necessary condition at the micro-level. Therefore, the CE requires modes of consumption which fit the related concepts discussed throughout this section, e.g. ethical and pro-environmental consumer behaviour. However, it is important to recognise that the CE also motivates consumption behaviour and economic practices that are significantly different from those typically studied in most existing research investigating said concepts. In particular, an inspection of the material-flow-strategies that characterise the CE through a consumer–cultural lens uncovers initiatives such as Product-as-Service-Systems, where consumers may be expected to sacrifice ownership of products and purchase the use of the product instead (i.e., use oriented Product-as-Service-Systems) or where ownership of the product is transferred to the consumer and the provider offers services aiming to extend the useful lifetime of the product over a period of time (i.e., product oriented Product-as-Service-Systems) (see Catulli, Cook and Potter, 2017). A further example that is worth mentioning is collaborative consumption, where consumer-to-consumer business models arise, aiming to maximise the utility of products across consumers, hence reducing the overall resource consumption needed to fill consumer needs in the market (see Park and Armstrong, 2017). Finally, the inter- and trans-disciplinary nature of the CE has implications for consumers even at the product design stage, since it advocates for stakeholder involvement and design processes directed at the better fulfilment of consumer needs (see Liedtke et al., 2015).

New modes and roles of consumption that are considered part of the CE, like the ones described in the previous paragraph, require that consumers acquire new consumption habits and engage in new consumption practices. Each of these new ways of involving the consumer has its own nuances and important differences which warrant their exploration independently from one another. However, these initiatives share their goal of contributing to making consumption more sustainable. As such, they are all also part of the broader construct of sustainable consumer

behaviour (SCB). Hence, while locally they are differentiated by their nuances and characteristics, in the global sense their shared positive impact on sustainability supports their equivalence.

These local and global perspectives do not represent incompatible views of consumer behaviour, they can be thought of as different scales on the same issue. At a more local or *zoomed in* level, specific behaviours, whose adoption is expected (or assumed) to correlate with increased sustainability of the overall system are explored. Here, the factors and mechanisms that are found to be relevant to explain behaviour relate to the characteristics and nuances of the behavioural context of interest. For example, when different industries (energy, food, fashion etc.) and consumption settings and stages (purchase vs. disposal) are considered independently from one another, the specific characteristics of each become theoretically relevant (Holloway et al., 2007; Herring and Sorrell, 2009; Loy et al., 2016; Raggiotto, Mason and Moretti, 2018; Testa, Sarti and Frey, 2019; Elhoushy, 2020; Parajuly et al., 2020; Si et al., 2020). On the other hand, from the general or *zoomed out* perspective, the focus shifts to mechanisms that influence behavioural adoption by virtue of its alignment with the concept of SCB more widely. Therefore, any behaviour is embedded in the SCB construct to the extent to which it contributes to improving sustainability (Takase, Kondo and Washizu, 2005; Van Nes and Cramer, 2006; Peattie, 2010; Thøgersen, 2014; Vergragt, Akenji and Dewick, 2014; McDonald, 2015; Torma, Aschemann-Witzel and Thøgersen, 2018). This offers a more global notion of behaviour, where the theoretical relevance of the nuances and characteristics of each specific behaviour (industry, setting etc.) is exchanged for that of factors that transcend each specific case's characteristics. The factors and mechanisms that become relevant predictors of behaviour from this general perspective cannot be expected to explain the adoption of each separate behaviour equally well. However, since they are more stable factors, knowledge about them has the potential to drive more significant behavioural change across contexts and industries.

These perspectives are different from, but complementary to, one another. For example, knowing the factors that affect SCB in the general sense allows research on specific behaviours, like recycling or engaging in collaborative consumption, to control for potentially confounding effects that could lead to over- or under-estimation of other locally relevant factors and/or mechanisms. Conversely, the local perspective highlights important nuances which the general perspective can also consider in organising behaviours according to their behaviourally relevant contextual nuances when employing a set of specific behaviours to operationalise SCB. As such,

both perspectives play a role in the literature, together with the additional task of integrating knowledge generated from both.

In both the local and general perspectives, the sustainability of specific behaviours is typically assumed by operationalising even the broader SCB in terms of specific behaviours that are considered useful in theory, but whose potential has been shown to often fail to meet expectations. For example, behavioural rebound effects have been shown to hinder the potential of recycling to increase sustainability of consumption (Catlin and Wang 2013; Sun and Trudel, 2017). Despite that recycling is still the most widely studied type of consumer behaviour that is considered green or sustainable (Singh and Ordoñez, 2016; Camacho-Otero, Boks and Pettersen, 2018). Moreover, it is also usually included in the operationalisation of SCB construct under the same assumptions. This is problematic since a general notion of SCB resorts to examining a behaviour's alignment with the sustainability of the system in order to establish whether it is sustainable (Peattie, 2010). Therefore, taking certain consumption behaviours to be sustainable at face value creates a gap between the definition of SCB and empirical attempts to explain and understand it. This is an issue in both the local and global perspectives, but less so in the former. For example, since 'recycling' describes an action which does not depend on its externalities, knowledge generated about said behaviour holds unambiguously. However, if one were to employ recycling behaviour as a proxy in the operationalisation of the construct of sustainable behaviour, conclusions are only reliable so far as recycling does actually positively contribute to sustainability.

The notion adopted in this Thesis respects the definition of SCB by calling sustainable only behaviours that contribute positively to the sustainability of the system (United Nations Environmental Programme, 2001; Peattie, 2010). Therefore, it does not suffice to identify and explore specific modes of consumption, or behaviours, that are considered a part of the CE and whose positive impact is assumed. Instead, behaviour is considered to align with sustainability, and therefore the CE, on the basis of its associated impact on the sustainability of the system, and not on one specific circular strategy or behaviour alone.

From the perspective of this literature review, research exploring specific behavioural strategies is currently scarce in comparison to the number of studies that investigate issues like consumption drivers or perceptions of SCB more generally (Camacho-Otero, Boks and Pettersen, 2018). There is little that a critical appraisal of the limited extant literature can say about research on these alternative practices. Therefore, this review focuses on problematising and uncovering

research gaps in existing research that draws from typical practices in sustainable and ethical consumption research, that can extend into the context of the CE.

In sum, although the CE has yet to be properly conceptualised in the literature, recent efforts by (Kirchherr, Reike and Hekkert, 2017) have yielded a carefully constructed definition from which the present research extracts its core understanding of consumption in the CE. This leads to the conclusion that SCB is a micro-level basis of the CE paradigm. Moreover, SCB has been previously conceptualised more broadly (e.g., Table 4) and knowledge in this realm remains relevant to the context of the CE. Particularly since its typically employed methods and theories are already spilling over to consumer research on CE (Camacho-Otero, Boks and Pettersen, 2018). Therefore, it is important to consider all the associated concepts in order to understand the nature of extant knowledge relevant to consumption in the CE. This is addressed in the literature search strategy employed in identifying sources for critical review for Section 2.5 (see Table 3 in Section 2.2 for a more detailed account).

In this section, despite being widely studied concepts, inconsistencies were identified among definitions and conceptualisations of SCB, ethical and other similar types of consumer behaviour (Table 4). Therefore, the following section addresses the question of what should be understood as SCB, particularly given that it must ultimately contribute to the attainment of sustainable development.

2.3 The 'reduce' strategy in consumption and a culture of sufficiency

Consumption patterns implied by the current economic context are unsustainable (Thøgersen, 2014; European Environment Agency, 2020). As mentioned in Chapter 1, the current free-market economic systems require that consumption constantly increases in order to sustain their fundamental premises of the economy and full employment. However, what does it mean for this economic system and its encouragement of a consumerist culture to be unsustainable? There are several empirical observations that illustrate this:

- "Earth overshoot day": The day, every year, on which that year's renewable natural resources have been exhausted. After that day, the world population is consuming from the stock of resources which is not replenished naturally. Simply put, this day marks the point at which the planet's yearly natural resource regeneration capacities have been exceeded by human–economic activities. The Global Footprint Network (Global Footprint

Network, 2023) calculates this every year. Since 1980, "Earth overshoot day" arrives earlier each year.

- "Planetary boundaries": These define boundaries on nine separate processes (Rockström et al., 2009; Steffen et al., 2015) which are set based on the planet's regeneration capacities, the conditions necessary for human life and human-originated perturbations on the ES. At least three of these (namely the rate of biodiversity loss, human interference with the nitrogen cycle and climate change) had already been exceeded to a worrying degree in 2008 (Rockström et al., 2009) and, since then, this has only gotten worse (Steffen et al., 2015).
- Soil erosion and degradation: Pimentel (2006) shows that degradation and erosion of soil is currently taking place somewhere between 10 and 40 times faster than the rate at which the soil can naturally be replenished. This results in the land becoming unproductive and by 2006, 30% of the world's workable land had suffered in this way.
- Non-renewable resources: By 2008, of the non-renewable resources currently necessary to support the technologically advanced industrial society, over 70% had already been deemed globally scarce (Clugston, 2012).

Although the above list is not exhaustive, it serves the desired purpose of supporting and illustrating the idea that the consumption implied by the current free market economic context is, in fact, unsustainable. This is further argued below.

A reasonable question to ask is how the problem of unsustainability can be tackled and what the impact of tackling it may be for society, the environment and ourselves as individuals. In order to address this, it is necessary to first understand the source(s) of the problem. Three main factors are identified by Thøgersen (2014), and Ehrlich and Holdren (1971), to be significant in determining the impact that human–economic activity has on the environment: global population size, people's income levels (i.e., their capacity to consume products and services in society; affluence) and technology. This can be summarised in the following equation, *Impact = Population*Affluence*Technology*, widely known as the *IPAT* formula (Kara et al., 2022). The interaction between these factors and their potential effects on sustainability are discussed below.

Global population is constantly increasing due to fertility increases in developing countries and life-expectancy increases. The average age of the population is set to increase as life-expectancy increases to surpass the life-expectancy at birth which remains effectively

constant (Reisch and Thøgersen, 2015). Furthermore, Assadourian, Starke and Mastny (2010) provide data depicting the possible sustainable population sizes for different per-capita amounts of "biocapacity" use (in global hectares). The biocapacity use per person is directly related to the per capita income and is, therefore, also a measure of how consumption affects the sustainability of the system. Their results show that with the global average per capita income of 2005 (i.e., at 2.7 global hectares of biocapacity/person), the maximum sustainable population size would have been of 5 billion (and not 7 billion as it was). These data support the affluence, or income factor, as being even more salient than population size (Assadourian, Starke and Mastny, 2010; Reisch and Thøgersen, 2015). Finally, the dominant perspective that technology will be able to solve ecological problems through innovation and the right policies (Reisch and Thøgersen, 2015) runs the risk of becoming counterproductive given the implications of Jevon's paradox and other rebound effects (Alcott, 2005; Herring and Sorrell, 2009; Catlin and Wang 2013; Sun and Trudel, 2017). More precisely, these innovations can result in increased efficiency allowing for enhanced production that can, in turn, drive further over-consumption of resources. Moreover, even products or services exhibiting technological innovations that mitigate environmental/social impacts cannot succeed unless the end consumers accept and adopt them. To summarise, although population and technological advances can prove to be very helpful in achieving sustainable development, they are not sufficient in themselves if the biocapacity consumed per capita (i.e., total consumption) is not addressed.

In spite of that, to date, the most prominent attempts to drive consumption patterns towards more sustainable, focus on the production of less impactful or more efficient product or service alternatives (i.e., green consumerism) (Barnett, Cafaro and Newholm, 2005; Brunk, 2010). Although these strategies can contribute to the solution, they are not enough. In fact, as Akenji (2014) explains, these attempts may have rather served as a "green card" to allow governments to seemingly address sustainability issues while still protecting a system that incentivizes unsustainable consumerist cultures and consumption patterns. Therefore, attempts for sustainability that do not explore deeper systemic changes fall short of acknowledging the fact that the free market economy, being solely driven by continuous economic growth (as currently understood), unavoidably results in unsustainable production and consumption patterns (Jackson, 2009). The implications of this insight are of great importance. Making consumption sustainable requires making changes to the economic system, the infrastructures and

institutions, the power relationships and the dominant lifestyles and consumption culture (Vergragt, Akenji and Dewick, 2014).

From a consumption point of view, this means a cultural transition from the current state of consumerism to one that values more sustainable lifestyles (Brown and Vergragt, 2016). The idea of sufficiency (Princen, 2005; Zhu, 2019; Millward-Hopkins et al., 2020) can play a key role in enabling the attainment of sustainable development. Sufficiency is concerned with the quantity ("how much") as opposed to the quality of what is consumed (e.g., green consumerism) (Barnett, Cafaro and Newholm, 2005; Brunk, 2010). Therefore, the central question to address is that of: How much is enough? Answering this requires finding the balance between individual/social well-being and ecological or environmental sustainability.

Both classical and ecological economists agree on the purpose of a market economy being a subjective non-material outcome: wellbeing (Dasgupta, 2001). However, the two perspectives differ with regards to the extent to which of man-made capital[3] may be limited in the provision of the ultimate goal of wellbeing. (Daly and Farley, 2004). The difference arises from the fundamental consideration that the generation of man-made capital implies the depletion of natural-capital, which is capital naturally available in nature and ecosystems. An ecological economist argues that the degree to which consumption of man-made capital can offer increased wellbeing, is limited by the implied depletion of natural capital. Making the realistic assumption that humans meet their most pressing needs first, for each additional unit of man-made capital consumed, the resulting increase in wellbeing becomes smaller. Similarly, the more natural capital is depleted in the generation of man-made capital, the more its capacity to provide wellbeing is undermined. Therefore, the cost of provision of man-made capital increases with each unit consumed. Hence, at some point, the value of producing further man-made capital is overtaken by the loss in wellbeing due to depleting natural capital. It follows from this perspective that a theoretical limit exists on the extent to which wellbeing can be increased through more consumption of man-made capital, and therefore there exists a production/consumption level that is enough or sufficient. A classical economist does not acknowledge natural capital, hence leading to a view that increased wellbeing can always and forever be attained through further consumption of man-made capital, at no apparent cost.

[3] Here capital refers to a stock of something, that can be physical or not, capable of providing goods and services to humans. For the present purposes, only capitals of a physical nature will be considered.

Additionally, since these ideas fundamentally challenge the current economic systems, finding this balance is not the only aspect of sufficiency that policymakers and the public often perceive as challenging (at the very least). Among the most prominent is the belief that achieving certain levels of well-being requires material possessions, which is not supported by scientific evidence. Instead, research shows that beyond a certain threshold, material possessions (or energy use) and well-being become decoupled from one another (Abdallah et al., 2009; Jackson, 2009). In fact, Inglehart and Klingemann (2003) also determined that the increase in subjective well-being due to income increases becomes non-significant beyond some level of income. For some time already, well-being and economic growth have been decoupled in developed countries (Daly and Cobb, 1989; Mulder, Costanza and Erickson, 2006; Jackson, 2009). Moreover, unsustainable consumption patterns have been linked to increases in inequity levels and vice versa (Wilkinson and Pickett, 2011; Vergragt, 2013). In other words, the well-being that can be achieved through material possessions, monetary gains or economic growth (as currently understood), is limited. This supports the existence of some rate or level of resource consumption that is enough, or sufficient.

A culture of sufficiency is also commonly argued against on the assumption that the human being is naturally greedy, the latter being a widely accepted feature of human nature (Roach, Goodwin and Nelson, 2019; Zhu, 2019). The argument then goes through the idea that consumerist cultures typical of liberal societies currently stem from deeper traits that are inherently human, making them difficult and unnatural to change (Lage, 2022). However, there are several strong counterarguments to this logic. First, the aforementioned challenge only arises if the current conception of liberal societies, which favour greed and consumerism, is assumed to be rigid. In fact, having to change this conception is far from a theoretical limit to sufficiency (Bruhn and Lowrey, 2012; Millward-Hopkins et al., 2020). Second, the question should not be whether a given strategy is challenging or natural to implement, but whether it is desirable or even necessary for collective/social wellbeing. This is particularly relevant when the feature of human nature in question is greed, which has been shown to lead to numerous patterns of unethical behaviour (Seuntjens et al., 2019). Finally, there exists ample research suggesting that consumerist culture is not a natural occurrence (Reisch and Thøgersen, 2015). In the case of the USA, for instance, it has been explained as the result of careful design and consequent interventions by think-tanks, government and trade unions, and the benefit of big businesses was its main purpose (Ewen, 1996; Botsman and Rogers, 2010; Brown and Vergragt, 2016).

The issues discussed above consider the formal definition of sufficiency (for the purpose of sustainability), its practicality and ethical aspects of the cultural transition. These are conceptual issues attached to a cultural state of sufficiency. Conversely, several practical visions of what a sustainable future that values a culture of sufficiency might look like exist such as, the Venus project (Fresco and Meadows, 2002), which proposes a resource-based economy, and the Sustaining Partnerships to Enhance Rural Enterprise and Agribusiness Development (SPREAD) Sustainable Lifestyles 2050 project (Mont, Neuvonen and Lähteenoja, 2014). However, the main challenges of the transition are attached to the development of strategies and policies aiming for such a cultural state (Reisch and Thøgersen, 2015). Given that the unsustainability of production and consumption is a natural symptom of the underlying system (which is based on a paradigm of unlimited economic growth), approaches targeting individual and voluntary change will not suffice, despite being useful (Jackson, 2009; Vergragt, Akenji and Dewick, 2014). Human behaviour is affected directly (internal process that derives in a certain behaviour) and indirectly (an external stimulus affecting an internal process in decision making and, consequently, behaviour) (Jackson, 2005), hence the previous discussion can be summarised as follows: Attempting to shift consumption towards being more sustainable by only affecting consumer behaviour directly is not possible. Successfully achieving this also requires the design of an appropriate context (or system) capable of facilitating the right behavioural change (i.e., indirectly). This insight, given that consumers are embedded in society, through norms and regulation, illustrates the need to consider institutions, which is addressed in the following section.

2.4 An institutional theory perspective on sustainable consumer behaviour

Institutional theory research has long emphasized the understanding of institutions as structural forces that induce stability (Meyer and Rowan, 1977; Zucker, 1987; Strang and Meyer, 1993). By distinguishing what is legitimate from what is not (i.e., by providing meaning), they facilitate the prediction of other agents' behaviour, making social interactions more stable and meaningful (Suchman, 1995). In other words, institutions influence agent-level behaviour eventually inducing homogeneity (stability) in the system. However, this process of legitimisation also occurs from the bottom-up, such that institutional agents (organisations, individuals etc.) can also shape the institutions. These two ways of legitimisation depict what neo-institutional theory terms "deterministic" (static; top-down) and "strategic" (dynamic; bottom-up) stages of the organisational field (Chaney and Slimane, 2014). Moreover, institutional order lies on three

fundamental pillars: regulative, normative and cultural–cognitive (Scott, 2008). The regulative pillar gathers institutional forces emergent from rules that are set, monitored for and sanctioned against at the macro level of societal organisation. The normative pillar includes prescriptive elements of norms, standards and values that drive institutional stability (Chaney and Slimane, 2014). Finally, the cultural–cognitive pillar is related to the cognitive structures through which meaning is created and the social knowledge shared across agents in a given institutional context (Scott, 2008). Therefore, these three pillars support every consumption behaviour, and so, changes in any of the three can influence behaviour (Chaney and Slimane, 2014). This illustrates two fundamental building blocks of neo-institutional theory (Scott, 2008), namely, the pillars of institutional organisation and legitimacy as a necessary condition for the stability of the institution.

The implications of these tenets are extremely relevant to sustainable consumption. First, they require that institutions are legitimised at all three levels (pillars) in order to stabilise. Second, legitimacy both determines the rules under which agents operate and is also a resource through which agents can drive institutional change (Chaney and Slimane, 2014). Lounsbury (2007) explains that institutions shape agents' cognition, therefore guiding their social behaviour, one of which is consumption (this describes an indirect effect on behaviour). As a result, taking a neo-institutional view on consumer behaviour can provide insights on the external and internal factors guiding or hindering sustainable consumer behaviour (SCB).

Existing groups and movements, such as the voluntary simplicity movement and others (Elgin, 1993; Doherty and Etzioni, 2003; Hamilton, 2010) that are attempting to support a shift in consumer culture through initiatives that target individual voluntary change (i.e., internal shocks to the system), are not large enough in scope and reach to drive systemic change alone (Reisch and Thøgersen, 2015). Therefore, the right legislation (effectively an external shock) must be put in place to support and guide this change at a large enough scale. That being said, initiatives such as the Transition Network (2023) aiming to facilitate the organised action of communities locally, sparking pro-environmental entrepreneurship, could potentially have a significant system-wide effect through practically exemplifying the future in a tangible manner for policymakers and society.

The need for evidence-based policy capable of driving behavioural change is recognized among policymakers (Cabinet Office, 1999; Bullock, Mountford and Stanley, 2001; Jackson, 2005). This implies the need to elucidate how macro-level strategies can drive the consumer–cultural

change required to achieve sustainable development. Some research streams work to elucidate governance opportunities that can drive change, most notably, system innovation research (Tukker et al., 2017) and evolutionary economics (Boulding, 1991). However, since individual agents' social behaviour arises partly due to the institutional context shaping and conditioning their cognition (Lounsbury, 2007), cognitive–behavioural effects must also be understood in order to complete the picture. That is, understanding the individual agent (consumer, household, organisation, etc.) level from a cognitive–social point of view, like in research streams such as psychology (Gilbert, Fiske and Lindzey, 1998; Haugtvedt, Herr and Kardes, 2018), microeconomics (Frank, 2008; Young and Zamir, 2014; Straßheim and Beck, 2018) and marketing (Ölander and Thøgersen, 1995; Wells and Foxall, 2012) is vital in ensuring the success of policies aiming to drive the right consumer–cultural change (Parajuly et al., 2020).

In sum, the consumer–cultural changes required for attaining sustainable consumption levels call for an institutional theory perspective that recognizes the need for sustainability to be legitimised at the regulative, normative and cultural–cognitive pillars. Through this lens, it is recognized that institutional agents can also affect institutional structures. However, in the context of sustainability, bottom-up initiatives have proven to be too weak to drive system-wide change. This calls for the recognition of governance's responsibility in laying the right environment and regulatory framework to shift consumer behaviour towards more sustainable. Finally, developing the right policies and context also requires an understanding of the cognitive–behavioural side of consumption, where the streams of research reviewed in more detail in the following section usually operate.

2.5 The intention–behaviour gap in sustainable consumption: Establishing the State-of-the-Art

As discussed in Section 2.3, sustainable consumer behaviour (SCB) is not only concerned with the quality, but also the quantity, of consumption. Furthermore, ethical consumption addresses consumption practices that entail ethical considerations. The consumption patterns that the current free-market capitalist systems require carry serious ethical weight given the associated social, economic and environmental impacts and risks. Therefore, ethical consumption is necessarily concerned with the issue of sustainable consumption. As a result, ethical consumption, like SCB, must also consider the quantity of consumption on top of its qualitative

features (e.g., green consumerism) (Barnett, Cafaro and Newholm, 2005; Brunk, 2010). This is not surprising given the overlap between ethical consumption and SCB illustrated in Section 2.2.

Abundant empirical research reports positive attitudes, preferences and behavioural intentions towards more sustainable (Laroche, Bergeron and Barbaro-Forleo, 2001; Loureiro, McCluskey, and Mittelhammer, 2002; Watts, Ilbery and Maye, 2005; Holloway et al., 2007; Van Doorn and Verhoef, 2011) and ethical (Maietta, 2004; Loureiro and Lotade, 2005; De Pelsmacker, Driesen and Rayp, 2005; De Pelsmacker et al., 2006) products, suggesting that, on top of associated environmental and social benefits, the sustainable/ethical aspects of products can be a competitive differentiating factor. As a result, the consumer behaviour literature in marketing, and consumer psychology exhibit a growing interest in SCB, ethical consumption and similar concepts (Catlin and Wang, 2013; Leonidou, Katsikeas and Morgan, 2013; Peloza, White and Shang, 2013; Haws, Winterich and Naylor, 2014). However, most extant research on SCB and consumption in the CE currently relies on self-reported data, often in hypothetical settings (Camacho-Otero, Boks and Pettersen, 2018; Auger and Devinney, 2007), posing significant limitations to the reliability of the results and the conclusions that can be drawn about actual behaviour (Auger and Devinney, 2007; Schwarz, 1999). Moreover, the common reliance on models built around the idea that intentions are a strong predictor of behaviour, characteristic of the widely favoured Theory of Planned Behaviour (Ajzen, 1991; Fukukawa, 2003; Camacho-Otero, Boks and Pettersen, 2018), means that the research has focused mostly on understanding the formation of intentions (Carrington, Neville and Whitwell, 2014). Therefore, extant studies tend to ignore the empirical claims from the wider social psychology and consumer behaviour literature that intentions may not generally be assumed to translate into behaviour (Morwitz, Johnson and Schmittlein, 1993; Ajzen, Brown and Carvajal, 2004). This has led to a poor understanding of the translation of intentions into behaviour in ethical contexts (De Pelsmacker, Driesen and Rayp, 2005).

Not surprisingly, abundant research in the SCB, ethical and pro-environmental consumption literatures agrees on the existence of an intentions-behaviour gap (IBG). This term refers to the following widely reported phenomenon: *There exists a strongly significant mismatch between consumers' stated attitudes and/or BI, and their actual behaviour* (Carrington, Neville and Whitwell, 2010). As an illustration of this mismatch, most Europeans report that they are aware of the unsustainability of current consumption patterns and the importance of resource effectiveness in overcoming it (European Commission, 2014). They also claim to engage in waste

management practices and to be willing to engage with new business models (European Commission, 2018). However, these claims do not match observations of the real world (Parajuly et al., 2020). Bernardes et al. (2018, p. 1) label the "inconsistency between what people say and what they actually do" (i.e., the IBG) as "the most consistent finding" within their literature review. Although not a new problem and having been reported in numerous contexts of individual ethical behaviour, the IBG phenomenon remains poorly understood (De Pelsmacker, Driesen and Rayp, 2005; Chatzidakis, Hibbert and Smith, 2007). The lack of studies capturing actual behaviour, rather than self-reported data, and the lack of heterogeneity in the models employed to study SCB are potential sources of the gap (Testa, Sarti and Frey, 2019). In sum, given the limitations that the IBG poses on the reliability of extant research, understanding the IBG constitutes one of the main challenges to be addressed by the SCB literature, as reported by Papaoikonomou, Ryan and Ginieis (2011). A more in-depth account of existing perspectives on the IBG follows.

2.5.1 Perspectives on the intentions–behaviour gap in sustainable consumption

Within the sustainable consumer behaviour (SCB) literature concerned with the intentions-behaviour gap (IBG), two overall perspectives can be identified (Davies, Lee and Ahonkhai, 2012; Shaw, McMaster and Newholm, 2016; Frank and Brock, 2018). The first, proponents of which Frank and Brock (2018) call modellers, attempts to find non-methodological explanations to the IBG. In other words, although typical survey methodologies are recognized to be partially responsible for the gap, other factors are considered to be more significant. Consequently, modellers attempt to identify factors and processes that may hinder SCB. Among the most common, are explanations of the IBG such as barriers to SCB of the likes of price premiums overtaking consumers' willingness to pay extra, the unavailability of sustainable/green alternatives and lower perceived quality (Wiederhold and Martinez, 2018; Frank and Brock, 2019; Nguyen, Nguyen and Hoang, 2019; Wang et al., 2019). Further common explanations of the gap include situational factors, such as citizen–consumer role conflicts (Frank, 2018), and information-based reasons like lack of knowledge or trust regarding some sustainable product/service (Foti and Devine, 2019) and information overload, typically present in a market setting (Torma, Aschemann-Witzel and Thøgersen, 2018).

Although the identification of barriers uncovers part of the puzzle, it remains to explore the processes through which these barriers influence the BI–behaviour relationship. Consequently, conceptual propositions have emerged that integrate several factors to model mechanisms of influence on the BI–behaviour relationship. Most notably, Carrington, Neville and

Whitwell (2010) model implementation intentions to positively mediate the BI–behaviour relationship and introduce actual behavioural control and situational context as two moderators of the relationship (Belk, 1975; Ajzen and Madden, 1986; Gollwitzer, 1999). Moreover, they model the strength of the BI–behaviour relationship as being positively affected by consumers' control over the behavioural experience (actual behavioural control) and potentially influenced by the context in which the behaviour takes place (situational context). Grimmer and Miles (2017) conduct an empirical test of Carrington, Neville and Whitwell's (2010) model and, while they find implementation intentions to positively mediate the intentions–behaviour relationship, as expected, they find behavioural control to only mildly moderate the relationship. Furthermore, situational context turned out to not have a significant effect under their operationalisation, leaving the model only partially supported. The authors also incorporate a further construct to Carrington, Neville and Whitwell's (2010) model in order to capture consumer involvement in environmental causes. However, its hypothesised positive moderation effect on the BI–behaviour relationship was only mildly supported by their results.

Potentially related to, and in coherence with, the idea of implementation intentions is the view posited by Construal Level Theory (CLT) (Trope and Liberman, 2010). Namely, that the IBG is a consequence of the construal level, or abstraction level, with which a given behaviour is mentally represented. With increasingly abstract representations, abstract attributes of the behaviour gain protagonism. This means that a behaviour that is more abstractly represented will highlight values, ideology and other abstract considerations. On the other hand, more concrete representations invoke concrete attributes of the behaviour like context, practical challenges and constraints, and so on. Central to CLT is the notion of psychological distance, i.e. perceived distance, which bears time, space, social and hypothetical dimensions. CLT's central hypothesis is that with increases in psychological distance come increasingly abstract representations of that which is being perceived (Baltatescu, 2014). Hence, behavioural intentions, necessarily prime a more abstract representation of a behaviour, relative to the behavioural context where it might take place. This is due to intentions being hypothetical and usually about the future, which increases psychological distance, and hence abstraction – according to CLT (Giacomantonio et al., 2010; Trope and Liberman, 2010). Therefore, this perspective understands the IBG as a consequence of the increased abstract representation associated with constructs of intentions and attitudes, relative to actual behaviour. Since implementation intentions are essentially specific plans to act on one's intentions, these can be thought of as intentions that are more

concrete (less abstract), hence bridging the gap between intentions and behaviour that emerges due to this tendency (Gollwitzer, 1999). The latter point serves to depict the coherence between the contexts of implementation intentions and the CLT perspective.

Another important perspective lies in the analytical framework of cognitive dissonance. Qualitative exploratory research in this line has found the lack of cognitive dissonance to be a significant perpetuator of the IBG (Chatzidakis, Hibbert and Smith, 2007; Szmigin, Carrigan and McEachern, 2009; Gregory-Smith, Smith and Winklhofer, 2013; McDonald et al., 2015). While different in goals and foci, these studies agree that consumers who have sustainable intentions tend to utilise strategies to neutralise psychological discomfort that results from the incoherence between their behaviour and their goals. McDonald et al. (2015) focus solely on identifying normalization strategies that green consumers use to lower the dissonant cognition emergent from travelling by plane, since it is highly impactful, while Szmigin, Carrigan and McEachern (2009) focus on conceptualising the "conscious consumer". Gregory-Smith, Smith and Winklhofer (2013) investigate and conceptualise the role of emotions and the prevalence of incongruent behaviour in the context of ethical consumption and Chatzidakis, Hibbert and Smith (2007) focus on incorporating a "neutralisation" construct into the Theory of Planned Behaviour framework, in the context of fair-trade product purchase. More recently, De Lanauze and Siadou-Martin (2019), developed and tested a model that focuses on understanding the role of psychological discomfort (originating from incongruent behaviours) in behavioural change in the context of meat consumption. The authors, like the aforementioned exploratory studies, include neutralisation-like constructs in the form of "trivialisation" and "detribalisation" of dissonant information. Their findings suggest that, while psychological discomfort does positively affect motivation to change the dissonant past behaviour, this tends to fade away with time. This suggests that the IBG may be enlarged over time through neutralisation-like strategies.

The second point of view, held by the methodologists (Frank and Brock, 2018), views the IBG as mainly a consequence of methodological biases. As discussed earlier, the preferred self-reported survey methodologies are considered to limit the reliability of results (Schwarz, 1999; Auger and Devinney, 2007). Under this category are understandings of the IBG that consider factors such as exaggeration and social desirability bias, whereby respondents are compelled to respond according to what they believe to be socially desirable, and not their individual thoughts and beliefs (Schwarz, 1999). Moreover, the effect of social desirability has been found to be particularly salient in an ethical consumption research context (Carrigan and Attalla, 2001).

Another significant factor identified by the methodologist perspective on the IBG is hypothetical bias, whereby responses to hypothetical questions may be biased by the respondents' imprecision in predicting their behaviour by just imagining a given scenario (Ajzen, Brown and Carvajal, 2004; Murphy et al., 2005; Araña and León, 2013). Moreover, since hypotheticality conforms one of the dimensions of psychological distance, these findings can be explained by CLT. Namely, increased hypotheticality implies an increase in at least one of the psychological distance dimensions, and therefore (ceteris paribus) a more abstract representation of the behaviour or situation of interest. On the other hand, Fuller (2016) conducted a study to identify the significance of the effect that such methodological biases have on the reliability of associated results and found that it is not typically significant. Similarly, Araña and León (2013) find the differences in adaptation levels of the consumer between the hypothetical and real market settings to be more significant than the hypothetical bias bias itself. However, such accounts are rare in comparison to the converse idea that methodological biases are in fact significantly limiting (Murphy et al., 2005; Auger and Devinney, 2007; Fuller, 2016).

While methodological constraints are potentially significant (Auger and Devinney, 2007), most research still uses self-reported data (Carrington, Neville and Whitwell, 2014) without addressing the associated limitations (e.g., social desirability, self-presentational biases and self-reporting exaggeration (Schwarz, 1999). Attempts to overcome these methodological limitations and explore the IBG have rarely followed experimental routes. On one hand, there are field experiments with point-of-sale observations, particularly in contexts of organic or fair-trade grocery purchasing (Araña and León, 2013; Campbell et al., 2015; Frank, 2018; Frank and Brock, 2018). Although field experiments offer significant qualitative insight into the moment of purchase, quantitative observations are limited by noise that cannot be controlled for and they are limited to a specific consumption setting. On the other hand, while experiments in a laboratory setting have also been conducted for similar markets (Loy et al., 2016; Frank and Brock, 2018; Govind et al., 2019), these do not in general meet incentive compatibility requirements and typically involve hypothetical settings with intangible consequences to participants' choices in the experiments. Namely, incentive compatibility requires that respondents must care about the problem raised by the survey and that they believe that their choices will have some real impact for them (Carson and Groves, 2007; Zawojska and Czajkowski, 2017; Hackethal et al., 2023). These conditions are necessary in order to ensure that behavioural data collected are in fact representative of actual behaviour (Cummings, 1997; Carson and Groves, 2007; Zawojska and

Czajkowski, 2017). Therefore, the observation/measurement of real behaviour in a controlled experimental setting for the exploration of the IBG in sustainable consumption is currently missing from the literature. For this reason, for example Govind et al. (2019), call for replication of their results using real monetary incentives, allowing the otherwise persisting methodological limitations of using hypothetical settings and non-compatible incentives to be addressed and overcome.

There are other, more marginal exploratory attempts to conceptually explain the IBG that cannot be classified as taking a methodologist or modeller perspective. For example, Zeng and Durif (2019) explore the idea that the IBG may be the result of the misalignment between consumers' perception of the impacts of a sustainable product alternative and the actual sustainability of the product as determined through life-cycle assessment. However, the IBG is not the focus of their study and therefore remains an unexplored idea. Moreover, as both methodologist and modeller perspectives suggest, this is unlikely to be the only, or most, significant source of the IBG.

In sum, there are currently two salient perspectives in understanding IBG in SCB, the modeller and the methodologist. In the former strand, that understands the IBG as originating from the models used, there are two conceptual propositions that are gaining traction that relate to the concepts of implementation intentions (i.e., specific plans to act upon one's intentions) and cognitive dissonance (i.e., the dissonance that emerges from not acting as intended), respectively. However, these have mostly emerged as exploratory studies and are far from widely validated. Therefore, the modeller perspective still requires inputs in the form of both, conceptual models and empirical tests. While a large majority of research within the methodologist perspective advocates for the significance of methodological biases, there have been few attempts to overcome and explore the effects of methodological limitations on the IBG by gathering data representative of actual behaviour. The field and laboratory experiments that have been conducted focus on purchasing behaviour in the context of organic or fair-trade groceries. Furthermore, extant experimental attempts in the field do not allow for the proper control of the experimental setting and extant experimental attempts in the laboratory fail to meet incentive compatibility requirements. Therefore, this Thesis calls for innovation towards abstract experimental approaches more common to the domains of experimental economics and psychology. Both methodological care and conceptual innovation are necessary in order to contribute to understanding the mechanisms behind SCB and the IBG.

The following section begins by considering methods for the elicitation of SCB employing self reports. These are discussed in the context of their precision in appropriately characterising SCB, and their ability to reliably reflect individuals actual behaviour. The section concludes by providing a brief overview of social dilemmas and the tragedy of the commons in the context of observing SCB through experiments in a laboratory setting.

2.6 Measuring sustainable consumer behaviour: Self-reports and laboratory experiments

Sustainable consumer behaviour has been defined as consumption behaviour that is "oriented toward sustainable development" (Peattie, 2010)(p. 197). Lange and Dewitte (2019) review existing self-reported methods for the measurement of pro-environmental behaviour, or sustainable consumer behaviour. Within the self-reported measures of sustainable consumer behaviour (SCB) that the authors identify, there are several approaches that differ in: (a) their focus on varying behavioural properties, (b) time frame (i.e., present, specified past or unspecified past) and (c) the generality or abstraction of the target behaviours. Notably, the review identifies three main types of approaches that have been used substantially. First, several measures of SCB have been designed to capture consumers' tendency to engage, or not, in pro-environmental behaviour across varying domains through questionnaire items and Likert scales. These reflect behaviour-specific pre-dispositions to behave pro-environmentally in some domain pertaining to SCB, or many domains simultaneously. Second, there are "diary procedures" where the participants are required to report on their SCB more than once, hence keeping a record of their target SCB over some established time (e.g. Maleetipwan-Mattsson, Laike and Johansson, 2013). While promising, these may be subject to behavioural reactions that occur due to self-observation, which are not desirable for diagnosis of actual behavioural patterns outside self-observation contexts (Newcomb and Mustanski, 2014). Finally, there are measures of individual environmental footprint that rely on the participants' self-reports of their habitual behaviours, focusing on key behaviours responsible for the largest portion of an average individuals' environmental footprint (Bleys et al., 2018). These measures of environmental footprint are particularly relevant, at least conceptually, given the discussion throughout this review about the importance of addressing the goal-side of the CE's definition.

Although impact-based environmental-footrpint-like approaches may appear to measure something different from behaviour, they are the only self-reported instrument that explicitly

considers the impacts associated with target behaviours. This is essential since, by definition, it is the impacts associated with the different behaviours that determine their sustainability, or lack thereof. Therefore, issues of sustainability partly require an analysis from a consequentialist perspective. Meaning that it does not suffice to (deontologically) set a number of rules about the quality (type) of consumption if said rules allow for aggregate levels of consumption that are not sustainable (i.e., whose impacts hinder their sustainability). In other words, SCB can only be properly defined and measured if the consequences (or impacts) of said behaviour are taken into account. A combination of diary procedures, which prime memory, with the impact-based EF-type measures of SCB may offer promising avenues for increased precision in the measurement of SCB through self-reports.

In practice, however, calculations mapping individuals' self-reports to an environmental footprint outcome are not always easily accessible. The Global Footprint Network (2023) does have a tool for the calculation of individual environmental footprint online, however, the associated questionnaire items and calculations are not explicitly available, like a lot of other data on the platform are. The initiative in question most often takes a more macro perspective tailoring their resources primarily to cross-national comparisons of biocapacity use (Galli et al., 2007; Kitzes et al., 2009). Therefore, despite the fact that using environmental footprint individual behaviour is already a reality (Bleys et al., 2018), this approach has much to advance before it can become commonplace in research on individual consumption. Most importantly, a transparent and scientifically evolving methodology must emerge that allows for replication and comparison of empirical results.

It is worth noting that taking a consequentialist perspective (mentioned above) is not incompatible with a deontological one. In fact, this Thesis argues that a combination of both is necessary. A consequentialist perspective is necessary in order to avoid distraction from the actual aim: addressing sustainability issues. On the other hand, a deontological perspective is necessary precisely because of the practical complexity attached to determining the impacts of specific initiatives and proposed solutions. This is especially the case when competing financial and political interests are present (Hepburn, 2010). For instance, such a deontological perspective is coherent with the conclusion that only moving away from consumerism and into a mindset along the lines of sufficiency can result in the attainment of sustainable consumption levels. This is a deontological statement, but also bears consequentialist considerations. Namely, the reason for the necessity of what can be seen as a solution that is extremely disruptive of current

individuals' lifestyles, emerges from a consideration of consequences which are hard to measure or determine. On the other hand, the fact that most of the solutions currently proposed have been shown to have technical and even behavioural drawbacks, characterised as rebound effects, cannot be dismissed (Alcott, 2005; Sun and Trudel, 2017). Hence the need to partially take a consequentialist view, rather than only focusing on specific actions like recycling or using an electric car, purely deontologically (i.e. ignoring what is known about consequences), as a sustainability-enhancing ethic.

In sum, efforts are developing towards decoupling individual perceptions from actual impacts in self-reported measures of sustainable consumer behaviour. The main approaches operate through priming memory (diary procedures), and environmental footprint linking individual responses to (global) impacts. However, the former, may significantly bias behavioural outcomes through unrealistically enhancing self-observation, while the latter is still nascent as a research tool for individual level consumption with accessibility issues. Despite that, these considerations of self-reported approaches highlighted the (at least partly) consequentialist perspective that studying SCB requires to avoid missing what actually makes consumption sustainable, i.e. the impacts.

2.6.1 Social dilemmas and the tragedy of the commons: Experiments in economics

Taking a step back, one may ask fundamentally why more sustainable behaviours and choices are not naturally reached while being generally desirable. Indeed, if it is generally desirable why wouldn't consumers naturally choose to behave more sustainably? The answer begins with unpacking who these behaviours benefit, how much, and in what way.

A social dilemma arises when individuals' optimal decision making is set to lead to an outcome that is less than optimal collectively (Liebrand, 1983). In other words, there is a conflict between what is "best" for the individual locally and what would be "best" for the collective. In general (and assuming its correct classification as being sustainable), a more sustainable choice of behaviour by a consumer is better for the collective good than a less sustainable avenue. This is because a choice being more sustainable, by definition, must imply ecological, social, and economic improvements with respect to less sustainable choices, all of which in one way or another contribute to improvements that are shared by everyone in the planet, i.e. the collective good. An equally valid and simultaneously true perspective on the same issue is that the

important globally incident costs that arise from unsustainable consumption patterns, are shared by everyone, whether these are physical or moral. The problem is that making the more sustainable choice often bears a direct cost for the decision maker, whether it is the case that such a choice costs more money, is more time consuming, requires increased effort, is less aligned with one's habits, there is a lack of infrastructure to support it, is less aligned with social norms or any other issue that might result in an individual cost to the DM, from making the more sustainable choice. As such, the individual costs of acting sustainably, which are experienced individually, can very often surpass those from acting less so, which are shared, this in turn creates an incentive for the decision maker to not act sustainably.

Resource extraction through consumption essentially describes a context where the shared resources are non-excludable and highly subtractable, such resources are also known as common resources or *commons* (Ostrom, Walker and Gardner, 1994). This just means that one person consuming does not prevent another person from doing so, which is certainly true at the resource extraction level, and that the level of consumption is not significantly constrained, which is true since the current individual affluence limit on consumption still allows for a lot more than the sustainable threshold and allows for continuously growing individual consumption levels as economies continue to grow by design.

The presence of the social dilemma that emerges from this context makes commons susceptible to what is known as the "Tragedy of the Commons" (Hardin, 1968), a situation where the system within which decision making is embedded incentivises the decision maker to extract effectively unlimitedly leading the finite resource to its unavoidable deterioration. Then, the question of shifting consumer behaviour towards more sustainable patterns is about understanding how the tragedy of the commons can be avoided in this context.

As argued by Hardin (1968), this cannot be achieved through appeals to individual responsibility alone since the system naturally favours non-cooperators. An institutional perspective further supports this idea: consumer behaviour (micro-level) is of paramount importance to setting up and stabilising the right institution of consumption towards sustainability, however, top-down efforts (macro-level) addressing the very foundations of the system giving rise to these incentives are simultaneously required (Georgantzis Garcia et al., 2021).

Shared commons scenarios have been amply studied using experimental methods in economics, a framework commonly referred to as common pool resource games, to understand

people's behaviour under these circumstances (e.g. Gardner, Ostrom and Walker, 1990; Fischer, Irlenbusch and Sadrieh, 2004; Camargo and Haydu, 2016; Tisserand et al., 2022; Herne, Kuyper and Lappalainen, 2023). In the experiments, real monetary incentives are designed into the game which are *compatible* with those of the situation of interest, which in this case is the social dilemma arising from commons (also commonly referred to as commons dilemma). This ensures that observed extraction or consumption behaviour is representative of participants' actual decision making under the same incentives, making the methodology particularly relevant given the limitations of self-reported accounts of behaviour. Additionally, it is particularly well suited to considerations about the quantity consumed, although it can also easily be adapted to incorporate or alternatively explore qualitative aspects too.

In sum, the common pool resource framework paves the way for experiments that have been extensively used in the economics literature and are well understood. Therefore, it is particularly well suited for addressing the gaps identified throughout this chapter. Since behaviour is observed directly rather than through self-reports, the intentions-behaviour gap (IBG) can be considered explicitly when measuring self-reports of intentions in parallel. Moreover, since there is full control over the experimental design and setting, elements of institutional setting can be explicitly measured and their influence on behaviour considered. Finally, given the resource-extractive nature of the decision-making the common pool resource framework entails, the consideration of quantitative aspects of consumption is facilitated by this context, while also enhancing the potential for qualitative observation simultaneously.

2.7 Conclusions from the literature review

The present critical review identified several key points that can be used as the ground on which to build a much-needed bridge between existing sustainable consumer behaviour (SCB) and other overlapping research, and research on consumption in the CE. In doing so, the review conducted in this chapter contributes to the research objectives of this Thesis by addressing the issue of the critical characterisation of consumption in the CE, and its relation to existing conceptions of and research on SCB. An additional contribution is the establishment of a connection between the growing discourse in the SCB literature, about the need for a shift away from consumerist cultures, and the incorporation of this idea into the reduce strategy within the CE framework. Finally, this Chapter contributed to the objectives of this Thesis by gathering and organising research on the intentions-behaviour gap (IBG) from different research contexts that

seek to understand sustainability-relevant consumption and decision making. This results in several research perspectives such as economics, psychology and marketing being incentivised to employ their methodological and theoretical strengths to further understand the IBG, and consumption in contexts relevant to sustainability considerations. This is a particularly relevant contribution in the context of CE research since the concept itself advocates for interdisciplinarity.

First, two core defining elements or pillars that are necessary in order to build the CE concept were extracted, among others, directly from Kirchherr, Reike and Hekkert's (2017) work and definition. These are: (1) There exists a hierarchy of CE-strategies stemming from the nR-framework, meaning that some strategies are preferred to others. In particular, the "reduce" strategy is considered preferential in enabling the success of the transition to a CE from the consumption side (see Section 2.3). (2) The definition of the CE consists of two separable parts: its goal, which can be summarised as the attainment of sustainable development; and its strategies for achieving the goal, which are subjected to the aforementioned hierarchy of priority. Therefore, only the combination of the CE-strategies together with their contribution towards sustainable development can be considered to align with this conceptualisation of the CE.

While the CE can be considered a fairly new paradigm, consumer behaviour that is oriented towards the attainment of sustainable development through often similar strategies has been studied to a reasonable extent under a number of names. However, these streams of research (ethical, responsible, pro-environmental, green and sustainable consumption or consumer behaviour) are characterised by a lack of heterogeneity in the theories used, focusing primarily on the formation of intentions, often falling short of building knowledge on actual behaviour. Moreover, the typical use of survey methods and self-reported data poses a further problem for these research streams. In particular, these issues give rise to a phenomenon known as the intentions–behaviour gap (IBG), whereby consumers report being environmentally conscious and intending to behave sustainably but fail to act accordingly. Putting the IBG at the centre of the discussion opens up interesting avenues for extending this type of research to the CE in an adaptive manner. Namely, it calls for innovation in the use of testable theoretical frameworks to understand SCB and factors around it like institutional setting and habits, relevant to the transition towards the CE. Moreover, the findings reported in this Chapter call for particular methodological care when working with self-reported measures of behaviour, through using impact-based instruments and diary procedures for instance. Finally, measuring behaviour in

laboratory–experiment settings where particular care is given to the design, in order to ensure incentive compatibility, has potential to offer a particularly interesting solution to the methodological shortcomings of SCB research.

The intentions-behaviour gap poses a significant limitation to research following the lead of the extant SCB, and related, literatures. More importantly, however, it uncovers both methodological and conceptual issues that need to be addressed by research. Namely, research employing self-reported data collection methods should attempt to use instruments that are less susceptible to social desirability bias and similar problems, such as impact-based measures or diary procedures. Of particular relevance to this Thesis are methodological innovations tending towards laboratory experiment procedures that meet incentive compatibility criteria when considering consumption in the CE or SCB as a whole, which offer a framework for observing behaviour without relying on self-reports. In addition, the remaining of this Thesis also attempts to measure and record the effect of methodological biases, in order to better understand the significance and nature of the potential methodological side of the IBG. Further, a novel conceptual model is built, which aims to understand the intentions-behaviour relationship by building on relevant theory, and its empirical testing are used to contribute to better understanding the IBG, but also SCB as a whole.

The following Chapter addresses the development of a conceptual framework leading to certain theoretical testable hypotheses. First, the theoretical background to the conceptual framework is provided, followed by the definition of the constructs and the development of hypotheses based upon the described theoretical background.

CHAPTER 3: CONCEPTUAL FRAMEWORK AND HYPOTHESES DEVELOPMENT

3.1 Introduction

The chapter preceding this one reviewed the literature critically to establish the current state of knowledge and identify meaningful research problems that are necessary to address. The present chapter deals with the development of the conceptual framework, including definition of constructs for subsequent operationalisation and the development of testable research hypotheses. The theoretical background, which builds on the literature review, is first introduced. Next, the grounds are set for addressing the research objectives developed in Chapter 1 (Table 1, p. 14), accounting for the findings of the literature review (Chapter 2), organised into a set of actions and steps (Section 3.3). The section concludes by introducing construct definitions and hypotheses.

3.2 Theoretical background to the conceptual framework

3.2.1 An overview of the intentions-behaviour relationship: Setting the foundations

In this section, the Theory of Planned Behaviour (TPB) is briefly introduced with the purpose of providing the necessary background for understanding the origins of the typical assumption that intentions significantly predict behaviour. It is worth clarifying that the TPB is not employed in this research as a theoretical nor conceptual model. However, the focus on the intentions-behaviour relationship that leads to the issue of interest, the intentions-behaviour gap (IBG), emanates primarily from the TPB model. Therefore, some background about the theory is introduced to the extent to which it provides more context into the emergence of the IBG in sustainable consumer behaviour (SCB) research. The goal of this conceptual framework is not to further test the TPB, as the problem of the IBG is a well established fact. Instead, the aim is to investigate the intentions-behaviour relationship itself, and not the formation of intentions. As a result, the only element of TPB that is of interest to this research's focus is the intentions-behaviour relationship, as further discussed below.

The Theory of Planned Behaviour (TPB) is a conceptual model of rational behaviour based around the idea that behavioural outcomes arise as a consequence of the formation of associated behavioural intentions (Ajzen, 1991). In turn, in the TPB, behavioural intentions mediate the effect

on behaviour of individuals' attitudes toward the behaviour, perceived behavioural control and subjective norms. This is developed in more detail below.

First, being a model of rational behaviour means that it takes behaviour to be the consequence of conscious reasoning by individuals, using the information available (Paz and Rodríguez-Vargas, 2023). The term 'planned' in the theory's name makes reference to this. This separates TPB from the concept of rationality in economics, which is associated more with the consistency of preferences rather than with the decision-making process being conscious. It is also a departure from the concept of habitual behaviour since the latter bears little to no reasoning, but rather a tendency to act in certain ways (Bourdieu, 2002; Gomes and Lopes, 2023). Moreover, it is a theory of individual behaviour that is general and not particularly well tailored to sustainable consumption contexts, where ethical and long-term considerations become critical (Kollmuss and Agyeman, 2002; Ajzen, Brown and Carvajal, 2004; Carrington, Neville and Whitwell, 2010; Carrington, Neville and Whitwell, 2014; Johnstone and Tan, 2015; Essiz et al., 2023).

Second, the formation of intentions is assumed to be satisfactorily explained by attitudes, i.e. the degree to which the individual holds a positive evaluation of the behaviour; subjective norms, which are the social pressures as perceived by the individual; and perceived behavioural control, which is the individual's subjectively perceived ability (or ease) to enact the behaviour in question (Ajzen, 1991). In turn, intentions are taken to mediate the effect of the aforementioned constructs on behaviour, making the former the only direct predictor of behaviour that the theory assumes (Ajzen, Brown and Carvajal, 2004; Li et al., 2018; Si et al., 2020). It is within this context that the intentions-behaviour gap (IBG) is observed: while studies using self-reports find a satisfactory degree of agreement between intentions and behaviour, this is not the case for observations of behaviour in the real world (see Section 2.5) (Ajzen, Brown and Carvajal, 2004; Carrington, Neville and Whitwell, 2010; Carrington, Neville and Whitwell, 2014). This is particularly problematic when the translation from intentions to behaviour is taken at face value, like many studies in sustainable consumer behaviour (SCB) research have done by focusing only on the formation of intentions empirically (Laroche, Bergeron and Barbaro-Forleo, 2001; Loureiro, McCluskey, and Mittelhammer, 2002; Maietta, 2004; De Pelsmacker, Driesen and Rayp, 2005; Loureiro and Lotade, 2005; Watts, Ilbery and Maye, 2005; De Pelsmacker et al., 2006; Holloway et al., 2007; Van Doorn and Verhoef, 2011).

The literature review (Chapter 2) revealed one cognitive process that has dominated research on SCB. Namely, that described by the Theory of Planned Behaviour (TPB) (Ajzen and

Madden, 1986; Ajzen, 1991). In particular, the intentions-behaviour relationship has been used not only as a basis for building hypotheses, but also assumptions from which conclusions about behaviour could be drawn. Unfortunately, the prominence of the IBG in SCB shows that the dominance of this cognitive process is limited by the research domain, and does not translate into the formation of actual behavioural outcomes as it is often expected, or even assumed, to do (Ajzen, Brown and Carvajal, 2004; Carrington, Neville and Whitwell, 2010; Carrington, Neville and Whitwell, 2014). However, this myopic focus on a single cognitive process, the one characterised by the intentions-behaviour relationship, is accompanied by the use of a specific survey methodology, which relies on self-reports and individual's interpretations (Frank and Brock, 2018). Therefore, the cognitive process itself may bear no fault, instead it may be the methodological assumptions and decisions typical of these studies that may lead to unrealistic conclusions, characterised as an IBG (Frank and Brock, 2018; Frank and Brock, 2019). Alternatively, the converse may be true, or what is probably most likely, that it is a combination of both theoretical and methodological issues that give rise to the IBG.

Therefore, and as developed in detail in the introduction, Chapter 1, and literature review (see Section 2.5), better understanding the mechanisms surrounding the IBG is the main means adopted towards empirically addressing the objectives of this Thesis. Naturally, to do so, the main relationship between intentions and behaviour is kept in the centre of the conceptual framework developed hereby. On the other hand, the mechanisms theorised around the intentions-behaviour relationship depart from Theory of Planned Behaviour in order to focus on an institutional perspective, and investigate the role of *abstraction bias*, which is proposed as a theoretical extension of the fundamental reasonings of Construal Level Theory in the following section.

3.2.2 Construal level theory: Abstraction bias and the intentions-behaviour gap

Construal level theory (CLT) has been used to offer a theoretical explanation for the intentions-behaviour gap (IBG). The theory links the abstraction of mental representations, to the distance perceived by individuals from what is being mentally represented. It posits that more psychologically distal behaviours, i.e. those perceived as being more far away, are construed more abstractly than those that are perceived as more impending. This introduction to the theory highlights the two central constructs in CLT, psychological distance; which is defined as perceived distance from what is being mentally represented, and construal level; with increasing construal

levels corresponding to increasing levels of abstraction of the mental representation (Trope and Liberman, 2010; Baltatescu, 2014). In turn, the construal level of a certain behaviour has consequences concerning subsequent behavioural outcomes. According to the theory, a higher construal level leads to a focus on abstract features of the behaviour such as values, general goals, self-identity and so on. In the converse case, when a low construal level characterises the mental representation of a behaviour, concrete practical issues associated with the behaviour such as, possibility, financial incentives or time constraints, become more salient. Therefore, CLT argues, increased psychological distance from a behaviour can lead to an overvaluing of abstract value-like attributes, leading to evaluations of the behaviour that may not be realistically matched once the behaviour becomes impending and more concrete considerations are perceived more saliently (Giacomantonio et al., 2010; Trope and Liberman, 2010). Similarly, decreasing psychological distance can lead to an overvaluing of concrete attributes related to possibility and comfort, resulting in situations where behaviour does not match one's values to the extent that may be expected.

Self-reported intentions, are necessarily related to more psychologically distal behaviours than actual behavioural settings since the former entail considerations often about different points in time and space, and are necessarily hypothetical. Trope and Liberman (2010) suggest this as a potential explanation of the IBG. Respondents may truthfully report intending to behave more sustainably, based on abstract considerations of behaviour. However, once in the decision context, when more concrete representations are activated; values and goals are put against contextual constraints, economic incentives and possibility. Leading to a significant reduction in actual sustainable consumer behaviour (SCB) relative to their reported intentions, i.e. the IBG.

In this Thesis, it is proposed that this idea can be generalised into a special kind of bias hereby termed *abstraction bias.* This characterises the bias that affects self-reports due to abstractly representing the associated behaviours or outcomes. In other words, this extends the idea that the IBG may arise as a consequence of intentions evoking more abstract representations of behaviour than actual behavioural contexts, into a continuous argument. Rather than discretely comparing intentions and behaviour as separate constructs, a continuum is envisaged such that any two behavioural considerations can be classified in terms of the abstraction of the mental representation they evoke. Then, it is proposed that as the distance between two representations on the abstraction continuum increases (i.e. one becomes increasingly more abstract), so will the subjective perceptual gap between them.

Hypothetical bias is one similar concept which has been widely explored (Murphy et al., 2005; Araña and Leon, 2013). It arises when hypothetical scenarios or cases are considered leading to self-reports that do not match actual behavioural outcomes in comparable settings (Ajzen, Brown and Carvajal, 2004). Therefore abstraction bias is related to, but different than, hypothetical bias since a question could be concretely framed but still completely hypothetical, which would definitely bear hypothetical but not necessarily a significant case of abstraction bias. In fact, since hypotheticality is only one dimension of psychological distance, hypothetical bias can be considered one special case of abstraction bias attached to one of the conditions which may increase the abstraction of a mental representation by increasing psychological distance, namely hypotheticality. However, this is not necessarily the case since for abstraction bias to arise, hypotheticality is required to result in significant increases in psychological distance overall, which may not always be the case when accounting for other dimensions of psychological distance, i.e. spatial, time and social, on top of hypothetical (Trope and Liberman, 2010). The latter idea is in line with findings in the literature where hypothetical bias was found to not be as significant as expected (Murphy et al., 2005; Araña and León, 2013). In other words, while abstraction bias may be the reason for hypothetical bias to arise at least in some cases, the concept of hypothetical bias does not require a specific mechanism, like the increase in construal level, to exist. Despite that, the concept of abstraction bias offers a theoretically sound basis for, at least partly, understanding the origins of hypothetical bias from a broader perspective.

Mental representations of intentions are intrinsically about more psychologically distal behaviours than an actual behavioural setting would entail. However, intentions themselves may also be framed as more abstract or concrete, priming different levels of construal. Hence, according to the proposed concept of abstraction bias, intentions are expected to differ increasingly from actual behaviour as the mental representation they prime becomes less concrete (lower construal). This is the theoretical basis employed in this research for the understanding of the effect that the abstraction of different operationalisations of intentions has on their degree of alignment with actual behaviour.

In administering a set of questions about behavioural intentions or behaviour, the behaviour of interest may be framed as more, or less, psychologically distant. More generally, concreteness may exist or lack in terms of how ambiguous the question's interpretation by individuals intrinsically is. This hypothetically asks: *if more than one, how many ways of interpreting the question are there?*. As the numeric answer to such a question increases, so does

the ambiguity and abstraction of the framing being assessed. In the case of intentions and behaviour, this ambiguity could arise on two axes, what the action itself entails (action and consequence), and the context or conditions where it is set. As proposed by CLT, more psychologically distal behavioural framings are expected to lead to higher construal levels. Therefore, there are two central elements affecting the construal level of a given behavioural framing, psychological distance and ambiguity. Moreover, these can be considered loosely as two sides of the same coin, for example increased hypotheticality leaves more space for interpretation, hence increasing ambiguity. The same goes for spatial and temporal distances, where the actual behavioural setting can be more unambiguously interpreted the more spatially close, and the more impending, the behaviour is expected to occur. As illustrated by these examples, in most cases, the psychological distance and the ambiguity perspectives converge.

In the context of operationalising behaviour and intentions through self-reports, less ambiguous operationalisations leave less space for potential abstraction bias. For example, due to an abstract representation of the behaviour activating a perception based on abstract attributes, that overlooks practical limitations that characterise the behaviour in reality. In fact, this is more a general methodological statement, that a good measurement instrument should strive to design out any potential ambiguity and unnecessary complexity to ensure individuals' interpretation matches that which was intended (Netemeyer, Bearden and Sharma, 2003; Diamantopoulos, 2011; Heale and Twycross, 2015). These facts play an important role in the IBG since aligning operationalisations of intentions to those of behaviour in a given study impedes the separation of actual statistical effects, from inflated correlations due to systematic biases like abstraction bias. This point is developed further below.

A framing of intentions may be more or less aligned with the a given operationalisation of behaviour, again both in terms of the behavioural outcome it presents, and the setting in which it takes place. For example, a set of questions about intending to recycle which do not specify a setting (*what is being recycled?; under which conditions?* etc.) will allow individuals to interpret the setting, and often lead them to doing so in abstract terms of the likes of their values. A question about the frequency of recycling in the previous week or month however no longer leaves as much space for interpreting the setting, since it is priming individuals' memory. Therefore, these measurement instruments would be aligned in behavioural focus but not necessarily in setting. It is to be expected that noise, and potential biases, due to interpretation of setting and abstract representations of behaviour will be introduced into subsequent statistical

analyses. This essentially describes a case of abstraction bias resulting in unrealistic research results.

A bias may be random, or systematic. Such that the tendency to interpret one meaning of a given item in a certain way may follow (systematic), or not (random), an observable stable pattern. When these biases are systematic, some interpretation of the question becomes more likely than others for a specific reason. In other words, there is an underlying mechanism which induces a tendency toward a given interpretation. This is for example the case when more abstract representations of behaviour, based on values, ideology and goals; are primed by more ambiguous questions (or questions about more psychologically distant behaviours), leading to an overestimation of individuals' intentions and behavioural adoption relative to actual adoption, i.e. abstraction bias. This is what makes the alignment of intentions and behaviour potentially problematic when their operationalisation is not concrete enough to be interpreted unambiguously. Well aligned operationalisations that leave too much space for interpretation of action or setting, in both intentions and behaviour, may lead to similar bias in both variables; effectively inflating the observed correlation between the two constructs. Precisely this describes a problem of endogeneity since it is an issue of omitted variables correlating significantly with both the explanatory (intentions) and explained (behaviour) variables, hence inflating the relationship between them.

Therefore, when investigating the intentions-behaviour relationship, it is not only important to observe behaviour rather than relying on self reports. It is also important to make sure that intentions are sufficiently concrete *and* well aligned with the behavioural outcome of interest, such that ambiguity is minimised. It may be tempting to operationalise intentions and SCB as more general, and hence abstract. However, doing so may have little to say about the real cognitive processes leading to behaviour in the real world, and more about individuals' mental representations of behaviours and interpretation of questionnaire items.

Understanding these systematic biases conceptually constitutes an important step towards uncovering individuals' perceptions and understandings surrounding the issue of behaving sustainably. This can certainly aid in understanding the reality which is experienced by individuals, and its alignment or lack thereof with the necessary institutional elements for actual SCB to be achieved. That is, the cultural-cognitive pillar of institutional order and its interconnection with the regulative and normative ones. For example, in a preliminary analysis published as Deliverable 4.5 of the ReTraCE (Realising the Transition Toward the Circular

Economy) project, an understanding that *consuming less* is perceived significantly differently from *consuming more sustainably*, was reached (Georgantzis Garcia et al., 2022). The results of exploratory factor analysis in Appendix D pointed in the same direction. This was done through an investigation of accordingly framed items of behavioural intentions which revealed much greater intentions to behave more sustainably than to consume less in general. This depicts a misalignment of individuals' perception of what being sustainable means, with the necessity to move away from consumerism, which the literature review (Chapter 2) established as necessary. However, most importantly, it illustrates the significance of the choice of framing of intentions in determining the outcomes of empirical research utilising them.

In sum, the foundations of CLT imply that intentions themselves, entailing more psychologically distal considerations of behaviour, intrinsically carry more abstract representations of behaviour than the actual behavioural setting. This means that abstract elements of the behaviour, like values and goals, will dominate perception while concrete practical attributes, like practicality or time constraints, may be overlooked. In turn, this leads to an overestimation of intentions, relative to actual behaviour, which offers an explanation for the IBG phenomenon. Furthermore, following the same argument, it is argued that this effect can also influence conceptualisations or framings of intentions that vary in the level of abstraction they incorporate. Therefore, while these operationalisations are all meaningful in understanding the perception of individuals, understanding the cognitive processes preceding behavioural outcomes should not overlook the issue of intentions framing.

3.2.3 Institutional theory in sustainable consumption: The relevance of setting

As explained in Section 2.4, consumption can be understood from an institutional theory perspective. This entails the conception that there exist structural forces that stabilise behavioural outcomes and patterns. These structural forces operate through providing meaning and legitimisation at three different levels, regulative, normative, and cultural-cognitive; often rather referred to as *pillars*. The regulative pillar captures institutional forces operating through rules whose compliance is monitored and actively enforced. The normative pillar refers to prescriptive elements in the form of norms and values that lead to stability. The cultural-cognitive pillar is associated with the cognitive processes that lead to meaning creation that originate through the social knowledge shared among institutional agents, i.e. culturally. This conceptualisation helps to highlight the often overlooked system-like complexity associated with

consumption patterns and behaviours. It does not suffice to consider individual cognitive processes leading to individual behaviour, factors external to the consumer are also essential.

An institutional theory perspective illustrates the narrowness of relying purely on individual-level solutions (i.e. individual responsibility) to problematic consumption patterns. However, it is still the case that the outcome of interest is agent-level behaviour. Specifically that of consumers in the context of this Thesis. A useful distinction can be made between factors that operate internally and externally, with respect to individuals, leading to a given behavioural outcome. Institutions are thought to shape agents' cognition leading to the behaviours we observe. Therefore, a complete picture can only be attained from considering individual cognitive processes together with the institutional setting in which they take place.

In this research, institutional theory informs the conceptual framework and methodology employed by ascertaining the importance of behavioural determinants that fall beyond individuals' cognition. Inspired by this, a conceptual model and research design are developed to test the relevance of such external influences relative to the intentions-behaviour relationship and gap. In other words, the extent to which the gap between intentions and actual behaviour may be a consequence of specificities of the institutional setting, in which consumption behaviour ultimately takes place, is investigated. This also provides the basis for assessing the robustness of empirical findings that take place without an explicit consideration for institutional setting, to the introduction of institutional dynamics – which cannot be avoided in the real world.

3.3 Linking the conceptual framework to research questions and the literature review

As explained in Chapter 1 (p. 14), this Thesis is organised according to three main research objectives. These relate, in the following order, to (1) conceptualising consumption in (and for) the CE, (2) identifying how associated behaviours in this context are perceived by individuals, and (3) uncovering the mechanisms behind the translation of intentions into CE-oriented behaviour. The first objective was primarily addressed through the literature review (Chapter 2). To address the remaining research objectives while building on extant research, a three actions are developed to guide subsequent theoretical and methodological decisions. These are then broken into steps which are to be taken to achieve each action's fulfilment through research design. The role of these actions and a summary of the interconnections of this Thesis' chapters is provided in Figure 1. The actions and steps are drawn from a simultaneous consideration of the overarching

research objectives and questions which underlie this Thesis, and the results of the literature review. As such, they provide a bridge between the objectives of this research and what is already known, that is explicit to both the researcher and the reader. These are shown in the following table (Table 5), organised according to their contribution to the corresponding research objectives, which are numbered as in Table 1 (p. 14).

Actions	Steps	RQ	Lit. Rev.
1. Investigate abstraction bias through different framings of self reported behavioural intentions that differ in degree of alignment with actual behaviour.	What possible kinds of administrations of behavioural intentions instruments are meaningful given the state of the art of research?	2.1, 2.2	Addressing methodological and theoretical aspects of the IBG.
	How do they differ between them, and relate among them, in relation to their role in behaviour formation?	1.2, 3.1, 3.2, 3.3	Assessing their importance empirically.
2. Investigate the role of other psychological and demographic factors in the formation of behaviour, and the intentions-behaviour relationship, in the context of abstraction bias.	What relevant psychological and demographic factors may play a role in the intentions-behaviour relationship that are meaningful to the present conceptualisation of sustainable consumer behaviour (SCB)?	3.3, 3.4	Determining relevant theory to the context of sustainable consumer behaviour (SCB) that moves beyond the TPB.
	What is their role in relation to abstraction bias represented by the different operationalisations of behavioural intentions?	2.1, 2.2, 3.3, 3.4	The role of relevant psychometric constructs in the IBG in SCB.
3. Investigate the influence of institutional setting on behaviour, and the intentions-behaviour relationship.	How can institutional setting be characterised in this research context, hence allowing for its operationalisation?	3.2, 3.3	Taking an institutional perspective on SCB.
	How does accounting for institutional setting affect the role and significance of intentions, demographics and psychological factors in the formation of SCB?	3.2, 3.3, 3.4	Exploring the actual effects of institutional setting, in light of the IBG.

Table 4. Three actions to bridge research aim and questions and literature review findings.

The first action in Table 5 reads, *"1. Investigate abstraction bias through different framings of self reported behavioural intentions that differ in degree of alignment with actual behaviour.*". It is effectively asking about the extent to which the intentions-behaviour gap may be a consequence of the operationalisation of intentions by means of abstraction bias. An angle which, to the best of my knowledge, has not been explored to date. Similar to the case of behaviour, self-reported intentions imply individuals' interpretation of the questions, opening the door to potential systematic biases. These biases being systematic means that they are to some extent recurrent/stable, from one individual to the next, when administered to research participants. Taken into the statistical domain this would mean that their differences are non-zero and statistically significant, hence satisfying stability between or within individuals, depending on research design and type of data. This could, for example, be modelled as factors being sufficiently different in factor analysis, or relating differently to other constructs in other statistical analyses like regression, or mean comparisons and so on (in no particular order; this is only an example aiming to illustrate the point preceding it).

The debate around the origin of the intentions-behaviour gap (IBG) has been divided into modeller and methodologist perspectives (see Chapter 2, p. 39). This issue can be considered primarily methodological. However, it is not just about whether self-reports are reliable as a methodological avenue, but also uncovering conceptual elements of intentions that are currently overlooked, and that could lead to operationalisations that suffer less from systematic biases.

Operationalisation (as is also made apparent throughout this chapter) first goes through an important phase of developing a conceptual framework. This significantly influences the choice of measurement instruments employed to capture the constructs of interest, and hence methodological elements. Moreover, the problem could also arise at the point of translating a (correct) conceptualisation into a (poor) measurement instrument. The existence of systematic biases associated with different operationalisations, due to individual interpretation being subjected to abstraction bias for example, effectively argues against the content validity of a scale. In other words, it may not in fact measure what it is supposed to, but something more nuanced and significantly different from alternative operationalisations. Therefore, through identification of said biases, the nuances affecting perception can be elucidated, paving the way for more precise and reliable conceptualisations of intentions.

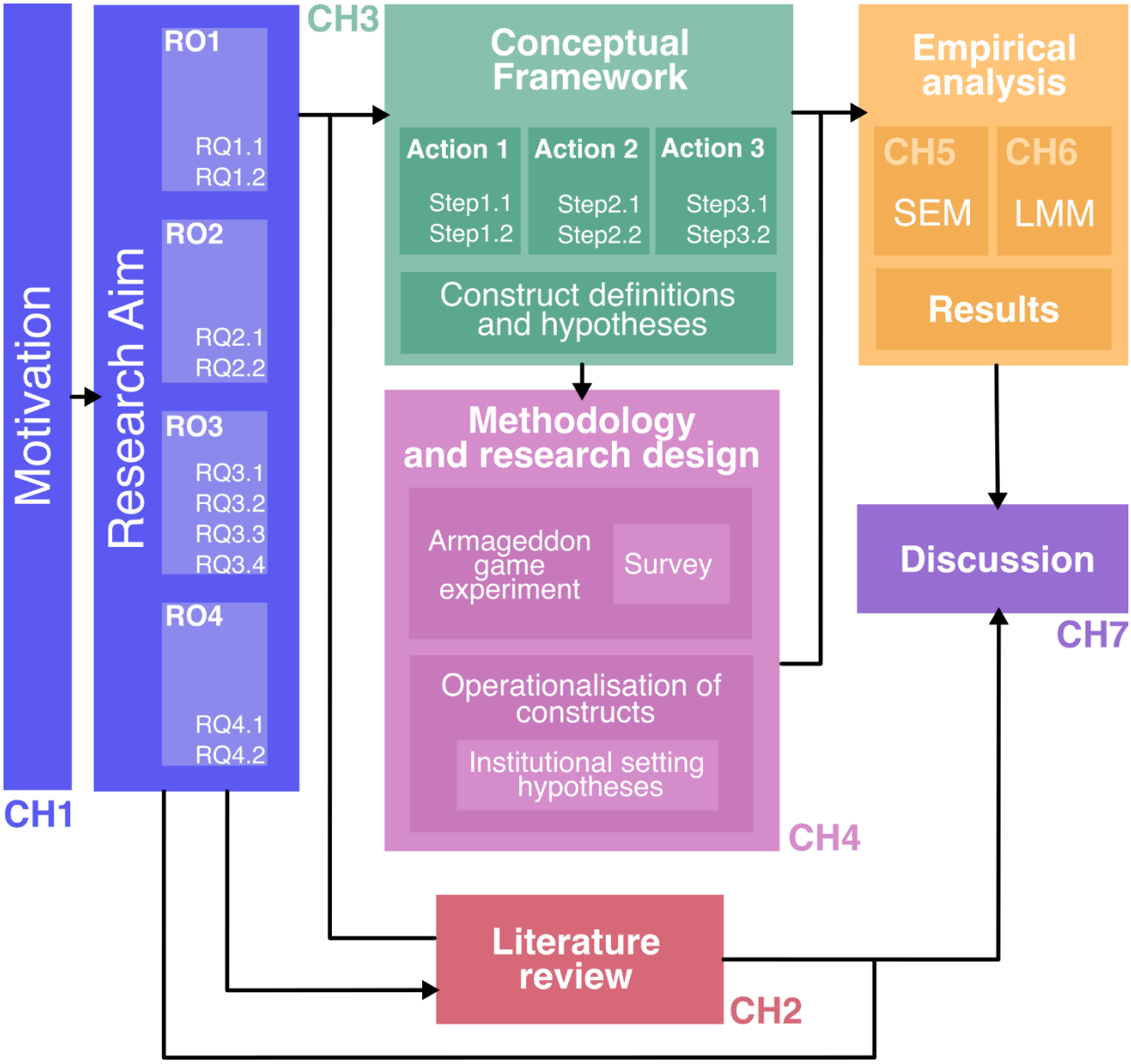


Figure 1. Schematic diagram of Thesis chapters and their interactions. The diagram shows the flow of the Thesis from one chapter to the next. Starting at the motivation, which leads to research aim, objectives and questions (Chapter 1); this then informs the literature review (Chapter 2). In turn, Chapters 1 and 2 contribute synergically to the development of the conceptual framework (Chapter 3). This involves the development of a set of actions, broken down into steps, which explicitly arise as a consequence of research objectives and literature review results. Operational definitions of constructs and related hypotheses are also developed in Chapter 3. The latter informs methodology and research design (Chapter 4), leading to the introduction of the Armageddon game experiment. In Chapter 4 constructs are operationalised and the concept of institutional setting is broken down into measurable parts in the experiment, leading to the development of corresponding hypotheses. Chapters 5 and 6 correspond to data analysis with structural equation modelling (SEM) and linear mixed modelling (LMM), to which Chapter 3 contributes hypotheses and Chapter 4 contributes data collection and further hypotheses about measured elements of institutional setting. Chapter 7 is a synthesis of the results, literature review and research objectives, highlighting contributions of this Thesis.

Uncovering systematic biases related to methodological elements, like the questions asked and the instruments used, offers an empirical input for the refining of conceptualisations and

subsequent operationalisation of intentions. Therefore, it is most appropriate to focus on exploring operationalisations that vary significantly and stably from one another in their alignment with actual behaviour, and on providing a theoretical justification for these differences – which can be empirically assessed (e.g. in the case of this conceptual framework, abstraction bias).

The second action, *"2. Investigate the role of other psychological and demographic factors in the formation of behaviour, and the intentions-behaviour relationship, in the context of abstraction bias"*, addresses the internal factors leading to behaviour, as well as their relation in the cognitive process embodied by the intentions-behaviour relationship. This is in alignment with the institutional theoretical perspective adopted in the present conceptual framework. This also illustrates how the first action ("*1. Investigate different framings of self reported behavioural intentions that differ in degree of alignment with actual behaviour*") is in fact addressing the central cognitive process (note the use of the word 'cognitive' here makes reference to the 'cultural-cognitive' pillar of institutional order) that is of interest to this research, i.e. the intentions-behaviour gap (IBG), in addition to its other methodological elements.

The third action "*3. Investigate the influence of institutional setting on behaviour, and the intentions behaviour relationship*" addresses the influence of institutional setting on behavioural outcomes, by also considering it while controlling for the role of intentions. In other words, the last action completes the picture in terms of the institutional theoretical perspective that is adopted, by addressing the role of factors external to individuals' cognition.

In sum, these three actions ensure that the institutional theory perspective is wholly represented by the conceptual framework. The first action lays down the foundation for the cognitive process of interest to this research, namely the intentions-behaviour relationship and its sensitivity to abstraction bias. The second action builds further on this cognitive process by introducing factors relevant to the connection between the IBG and abstraction bias. Having established the internal factors and mechanisms of interest, the third action fits the internal processes that were investigated by means of the first two actions, into the institutional setting surrounding them. Overall, the three actions help to develop a focus that is aligns with the needs of the sustainable consumer behaviour literature identified in Chapter 2 (literature review), by providing a clear focus on the IBG, abstraction bias, and their relationship to institutional setting.

The following sections begin to address these actions, and hence the objectives of this Thesis, by building the conceptual framework on which subsequent methodological decisions

will rest. First, the definition of sustainable consumer behaviour employed hereby is introduced and its implications explained. Subsequent sections are organised such that behavioural intentions are introduced first, followed by psychological and demographic factors, then concluding with institutional setting. In other words, they are ordered according to the order of formulation of the actions (as in Table 5) to which they relate. Hypotheses are developed in each of the sections pertaining to a construct, or set of constructs. Their development is based on the theoretical background introduced in the previous section (Section 3.2) and is reasoned in detail prior to their explicit formulation.

3.4 Operational definitions of constructs and hypotheses development

In order to address the three actions and their underlying steps, I first provide a clear definition and characterisation of the behaviour to which they make reference. Moreover, theoretical hypotheses are built, based on the theoretical background of Section 3.2 above. The section is organised such that sustainable consumer behaviour and intentions are introduced first since they represent the backbone of the intentions-behaviour gap (IBG) and the conceptual framework of this Thesis. Next, psychological distance to climate change is introduced followed by gender and risk aversion. An institutional perspective, including dispositions toward sustainable consumption as a measure of the cultural cognitive pillar, and institutional setting accounting for the normative and regulative pillars, are introduced last. Some of the conceptual framework greatly benefits from the inclusion of research propositions which lay the grounds for the development of subsequent testable hypotheses. This is discussed in more detail below, before moving on to the sub-sections pertaining to definition and hypothesis statement.

The role of propositions and hypotheses

This sub-section briefly outlines the differences between propositions and hypotheses, their role in theory development and testing, and their relevance throughout this section. First, it is worth noting that the aim of this section is to introduce rigorous operational definitions of constructs that are sufficiently specific to enable measurement, and subsequently develop testable hypotheses about how these relate to one another. Now this will be put in context of theory building and testing in the social sciences.

Ulaga et al. (2021) explain that theory building and testing relies in a sustained interaction between the theoretical and empirical realms, through two processes that the authors term

theorising and empiricising. The former refers to the use of conceptualisation and generalisation in the interpretation, and translation into theoretical terms, of empirically observed phenomena and their interactions. The latter refers to the transfer of theoretical terms into empirical ones through operationalisation, enabling their measurement and testing of their relationships. Within this framework, propositions can be understood as the counterpart to hypotheses, in the theoretical realm. Having established a conceptual domain based on theory and empirical knowledge, a proposition goes a step further to make a novel statement about the relationships between concepts, contributing to building a conceptual model (MacKenzie, Podsakoff and Jarvis, 2005; Cornelissen, 2017). As this characterisation suggests, propositions are not required to refer to neither measurable nor testable relationships, while hypotheses are. Hypotheses have been defined as "empirically testable statements specifying main, mediating, and moderating effects between constructs or empirical variables that, in their combination, build a research model" (Ulaga et al., 2021; p. 400).

As explained at the beginning of this section, the present chapter deals with the definition of constructs and development of hypotheses. This, in terms of the above discussion, refers to a process of empiricising and therefore must go through a process of transferring theoretical terms into the empirical. In most cases, the constructs introduced are specific enough to be easily transferrable to measurable variables and develop hypotheses based on the conceptual domain itself (Ulaga et al., 2021). In the case of institutional setting, due to its complexity and potential to relate to several different constructs, the concept is first narrowed further into the empirical realm, such that specific measurable variables can be defined, before any meaningful empirical statements, i.e. hypotheses, are constructed. This is done through the introduction of a number of propositions that provide a basis for understanding how the concept of institutional setting theoretically relates to that of sustainable consumer behaviour. This then allows for testable hypotheses to be developed in coherence with, and using the language of, the theoretical statements, i.e. propositions, that are laid out in this section (Section 3.4.7). The specific hypotheses are listed in Section 3.4.7 (Table 6, p. 76) to maintain coherence in the structure of this Thesis. However, the specific rationale behind these hypotheses in detail, is presented in Section 4.4.6 (p. 112) having first introduced operationalisation of the constructs which institutional setting is argued to incorporates.

As explained in the introductory paragraph to the present section, the following discussion deals with the operational definition of sustainable consumer behaviour.

3.4.1 Sustainable consumer behaviour: An operational definition

Sustainable consumer behaviour (SCB) has been defined as behaviour that is oriented toward sustainable development (Peattie, 2010). This is a good starting point to consider what actually makes consumption sustainable, as was done in Chapter 2 (Section 2.2). However, it is potentially too broad a definition making it potentially ambiguous in operationalising SCB for empirical analysis. Therefore, the following definition is developed which is in better harmony with subsequent empirical operationalisation. **Sustainable consumer behaviour (SCB) is that which contributes positively to the sustainability of the resource-generating system in which it occurs**. It is worth mentioning that here the word resource is used in a general sense, to mean anything which contributes to human-ecological wellbeing. For example, the absence of surplus CO2 in the atmosphere which would lead to further global warming is also a resource in this sense. In other words, it contributes to keeping human affairs within the regenerative capacity of the system, which addresses the environmental dimension. Furthermore, the definition is sufficiently general to include the social and economic dimensions of sustainability too. That is, resources in this general sense do not only include raw materials for the production of man-made capital. They also include the proper and sustainable functioning of social and economic processes, which are necessary to maintain social welfare for both human beings, and the natural-ecological environment in the Earth System.

At a conceptual level, the definition can be understood as requiring an equilibrium between operating within planetary boundaries, and addressing the anthroposphere's fundamental needs. At an operational level, it opens the path for developing a precise operationalisation of behaviour, provided the mechanisms governing the resource-generating system which the definition references is sufficiently concrete. Once the system is specified, SCB is bound to be well-defined, regardless of whether the focus is more pro-environmental, pro-social or a mixed more complex behaviour.

This definition of SCB could lead to a discretised interpretation. Behaviour either *is* or *isn't* sustainable. This conception has potential benefits in that it explicitly shines light on the complexity of SCB. Rigorously, only production-consumption patterns that operate within the system's capacity should be considered sustainable, because sustainability only matters once it is achieved. Approaching it without reaching it may delay the catastrophic outcomes that come with unsustainable human-economic affairs, but it can not stop them. However, it is also true that,

between two individuals who enact different behaviours, their contribution to the sustainability of the system is unlikely to be the exact same. Even between consumers whose contribution to sustainability is negative, one will likely be less negative than the other. It is in this spirit that rather than a discrete quality, SCB is hereby regarded as a continuous construct on which individuals may be scored and compared. In sum, the focus lies not on whether a behaviour is or isn't sustainable, but on how sustainable it is given its context.

It is worth noting that the choice of continuum-like conception of the SCB concept is most useful practically. Moreover, it is in line with typical operationalisations of SCB, green, pro-environmental, and other behaviours. However, making the decision explicit is paramount. It provides context and perspective on the conclusions that can be drawn from results emerging from such a conceptualisation. When considering the factors that make people behave *more* sustainably (or pro-environmentally more generally), there is not much the results can say about whether these differences are enough to make such a behaviour satisfy the definition of SCB. This is one strength of the definition developed here. While it can be adapted to the question of what makes people more, or less, sustainable; it explicitly acknowledges that only actually operating within the limits of the system can be considered sustainable in itself.

From the definition of SCB developed hereby, some important implications follow. Whether behaviour is more, or less, sustainable is determined by its resulting impact on the system. Specifically whether it contributes more, or less, positively to a use of the resources that respects the system's capacity to provide, and keep providing them. Any consumption behaviour entails externalities (hereby understood as part of resource use) which the system works to produce and maintain. Therefore, this conceptualisation of SCB can be thought to capture any possible behaviour, at a fundamental level. Even when the behaviour of interest is abstracted away from these general considerations of the resource produced by the system, a level of resource use exists (theoretically), to which the behaviour can in principle be mapped theoretically (and therefore also estimated empirically). Therefore, according to this definition, SCB is always a matter of quantity relative to the use of the resources that the system produces, whether that is a direct reduction of resource consumption, or indirectly, such as when purchasing less impactful products.

A quantitative perspective on behaviour is also in line with the hierarchical nature of SCB identified in the literature review (Chapter 2, p. 25). That is, since lower entropy solutions should be prioritised, according to Kirchherr, Reike and Hekkert's (2017) definition of the CE, *reducing* is

one of the most (if not the most) significant strategies (high impact) that can be taken toward the Circular Economy and sustainability. It was already shown in the literature review (Chapter 1, page 32) that high entropy, technology-heavy, solutions like recycling are limited by several rebound effects that have been conceptualised and empirically observed in the literature (Alcott, 2005; Herring and Sorrell, 2009; Catlin and Wang 2013; Sun and Trudel, 2017). Therefore, while one may run to critique the generality or abstraction of the conceptualisation of sustainable consumer behaviour developed here on the basis of pragmatism, the conclusion to which it leads is better grounded in reality than its alternatives. Namely since the latter systematically overlook the actual impacts associated with the high-entropy behaviours on which they tend to focus.

The next discussion addresses the development of hypotheses relative to how behavioural intentions framings of different levels of abstraction interact with each other and, in turn, behaviour.

3.4.2 Behavioural intentions: varying levels of abstraction

In line with the first action presented in Table 5 above, this section considers and develops hypothesis around the relationship among framings of intentions of varying levels of abstraction, and with actual behaviour. As abstraction of an intentions framing is increased, Construal Level Theory (CLT) predicts that the influence of abstract considerations on perception of the behaviour also increases (see Section 3.2.2). These considerations (values, goals…) are an idiosyncratic attribute of individuals. This means that less abstract framings of intentions are expected to relate to other, more abstract framings, since they may share the same basis to some extent. Next, by introducing the concept of implementation intentions, hypotheses are constructed relating to how these different framings interact among each other and with actual behaviour.

Implementation intentions are specific plans to act on one's intentions, often conditional to certain contextual cues. They have been theorised, and empirically shown, to be an important mediator of the intentions behaviour relationship (Gollwitzer, 1999; Loy et al., 2016; Grimmer and Miles, 2017). However, from a CLT and abstraction bias perspective, implementation intentions can be considered intentions that embody a less ambiguous (hence more concrete) framing than the intentions whose relationship with behaviour they mediate. Therefore, they align more closely with the behavioural setting allowing for practical considerations to be better taken into account by individuals. In other words, intentions that are framed more concretely act like implementation intentions with respect to intentions constructs that use more abstract framings.

In doing so, they are expected to narrow the gap between intentions and behaviour. This offers both a theoretical and empirical basis for the construction of the following hypotheses (Giacomantonio et al., 2010; Trope and Liberman, 2010; Spence, Poortinga and Pidgeon, 2012; Loy et al., 2016; Wang, 2019):

Hypothesis 1: *Intentions' influence on behaviour is mediated by other intentions that are framed less abstractly.*

H1a: *The mediation effect of more concrete intentions, in the relationship between more abstract intentions and behaviour, is positive.*

Hypothesis 2: *More concretely framed intentions have a stronger total effect on actual behaviour than more abstract framings.*

H2a: *The total effect of any framing of intentions on actual behaviour is non-negative. In other words, it is either positive or non-significant (i.e. not sufficiently different from zero).*

Notably here, the role of implementation intentions is abstracted away from its usual conceptualisation, and brought into the realm of abstraction bias. This allows for more general perspective to emerge about a continuum of abstraction of representations, rather than a binary distinction between regular and *implementation* intentions. Therefore, beyond current knowledge, confirming these hypotheses may offer a more general and fundamental explanation for the success of implementation intentions in narrowing the gap between words and deeds. This does not challenge the usual understanding of implementation intentions and their mediating role. Instead it offers a more general perspective on the same issue, at a fundamental perceptual level, by interpreting extant findings on the role of implementation intentions through the fundamental implications of CLT, through abstraction bias. Creating this bridge can pave the way to a more general understanding of the intentions-intentions-behaviour relationships, offering potential for more stable results across individuals and/or time.

3.4.3 Psychological distance to climate change

Another construct whose conceptualisation is grounded in Construal Level Theory (CLT) is psychological distance. This section discusses its definition and develops hypotheses based on theoretical predictions and extant empirical findings from the literature at the intersection between CLT and the intentions-behaviour gap.

One consequence of CLT, which was described in more detail in Section 3.2.2, is that direct experience is more important than information availability, in driving sustainable consumer behaviour (SCB), since the former reduces perceived (psychological) distance more than the latter (Johnstone and Tan, 2015). Psychological distance has temporal (later vs. now), spatial (there vs. here), hypothetical (known possibility vs uncertain possibility) and social (them vs. us) dimensions. CLT posits that increasing psychological distance from a behaviour results in increasingly abstract representations (i.e. an increasingly high construal level) (Trope and Liberman, 2010; Johnstone and Tan, 2015; Schill and Shaw, 2016). Moreover, the construal level of something is also theorised to positively affect psychological distance to that which is perceived. For example, more abstractly construed behaviours use descriptions that focus on primary, goal-related and moral aspects of the behaviour (the why) and when construed at a low level, i.e. less abstractly, they emphasise the subordinate goals or actions employed in the attainment of superordinate primary goals (the how).

Schill and Shaw (2016) highlight the relevance of CLT in considerations of the intentions-behaviour gap (IBG) in SCB by qualitatively exploring how psychological distance from, and construal level of, a behaviour can influence its adoption. The authors find that in the context of SCB, concrete (low) construal triggers a perception of the behaviour that reflects feasibility/possibility and highlights achievement, making it more likely to occur. This is in line with Johnstone and Tan's (2015) observation that direct experience, and therefore reduced psychological distance and construal level, can drive SCB. Some previous research suggests that construing SCB more abstractly highlighted their motivational attributes, thus driving the behaviour to take place (Giacomantonio et al., 2010; Kivetz and Tyler, 2010). However, these claims fail to consider the IBG and collide with findings in the wider goal-attainment literature that a low construal of behaviours, helps the behaviour take place by highlighting practical actions necessary for its attainment (e.g. implementation intentions) (Schill and Shaw, 2016).

Psychological distance (PD) is the perceived cognitive separation between self and an object or concept outside the self (Baltatescu, 2014). It has spatial, temporal, hypothetical and social dimensions. Therefore, psychological distance to climate change is defined as *the perceived cognitive separation an individual experiences relative to the concept of climate change and its potential and actual effects; on the temporal, spatial, hypothetical and/or social dimensions*. This definition means that PD naturally bears idiosyncratic elements to do with individuals' tendencies to perceive the issue of climate change more or less distant. Then, according to Construal Level

Theory (CLT), psychological distance will negatively affect intentions and, in turn, sustainable consumer behaviour. Meaning that as individuals become more psychologically distant from the issues of sustainability, they can be expected to decrease their intentions to behave in line with addressing them. Therefore, any potential effect of psychological distance on behaviour is expected to be negative, and through intentions.

Abstract framings of intentions depend mostly on abstract attributes of the behaviour, like values, while more concrete framings depend more on concrete attributes, like the actual individual costs implied by the action (e.g. time, effort, money, etc.). Psychological distance informs individual perception about how pressing addressing the issue at hand seems, i.e. how worth is it to address. For example, assuming a group of individuals with homogeneous values about sustainability issues, it is natural to expects similar levels of intentions to behave sustainably when the actual actions to be taken are left unspecified. However, if in the same context, of homogeneous values within the group, the question is less ambiguous, in terms of the actions to which it refers, intending to behave more sustainably will still depend on more concrete considerations, like individuals' perception of how pressing the issue is relative to the costs such actions imply. This illustrates how, perception and psychological distance, bear more significance when intentions are framed more concretely.

While perception, and psychological distance, can also be influenced by values, this just implies the expectation that more abstract framings of intentions should be predicted by value-like constructs more directly than concretely framed intentions. On the other hand, concrete framings of intentions are better determined by psychological distance, since how pressing the issue seems informs the costs one is willing to incur to address it. Therefore, psychological distance is expected to better align with, and predict, intentions when they are framed concretely than abstractly, and increasingly so. In other words, an individual's psychological distance, to climate change in this case, is expected to bare more significance in explaining concrete intentions than abstractly framed ones. In sum, when the action and setting are less ambiguous, individual differences in their tendencies to perceive climate change as more or less distant, are expected to become more significant. This rationale leads to the formulation of the following hypotheses:

Hypothesis 3: *The relationship between psychological distance and intentions is stronger the more concrete the framing of intentions.*

Given the above hypothesis and H2a, it is expected that the total effect of PD on SCB will be negative and significant. It is hypothesised as negative since increasing PD is expected, by abstraction bias, to result in decreased SCB adoption following the formation of a more abstract representation of the behaviour. This is formulated as the final hypothesis of this section:

Hypothesis 4: *The total effect of psychological distance to climate change on actual behaviour is negative.*

The following section defines and discusses dispositions as the basis for conceptualising and building hypotheses about the cultural-cognitive pillar of institutional order.

3.4.4 Dispositions towards sustainable consumption: The cultural-cognitive pillar of institutions

As explained in Section 3.2.3, taking an institutional theory perspective on sustainable consumer behaviour highlights the need to consider both internal cognitive processes and influences of factors external to individuals, in order to understand behavioural outcomes. As such, capturing understanding the structural forces of the three institutional pillars on behaviour is one of the aims of the present conceptual framework. A necessary step is to capture the cultural-cognitive pillar, which operates internally to the individual in the formation of sustainable behaviour. The cognitive process that is of the focus of this research, which characterises the internal cognitive aspect of institutions referred to hereby, relates to the influence of perception on the intentions-behaviour relationship, by means of a phenomenon encapsulated by abstraction bias. Having introduced definitions and hypotheses about intentions, psychological distance and sustainable consumer behaviour, what is missing from the picture is to add the cultural aspect of the 'cultural-cognitive' pillar.

A construct helpful to this end is that of dispositions, theorised in sociology and psychology literature streams to play an important role in the formation of behaviour (Bourdieu 1977). From the sociology perspective dispositions are seen as stable and durable tendencies toward cultural understandings of the world which enable or drive individuals to perceive, conceive and act (Bourdieu, 2002). In psychology, dispositions appear in the context of personality research and they are considered traits, or attitudes, but more stable, which manifest themselves through recognisable complex behavioural patterns (Alloport, 1937). Within this context they are related and overlapping with personality traits which overall are said to characterise individuals' personality (Chaudhari and Thakkar, 2019). The stability of dispositions

and their cultural origin, which can be deduced from a combination of the sociology and psychology perspectives, underline the relevance of dispositions when taking an institutional theory perspective in the context of consumption and even more so in sustainable consumer behaviour (Funder, 1991).

More recently, the sociology and psychology perspectives have been combined to define dispositions in a consumption setting, i.e. consumer dispositions, as "reliable latent tendencies that inform and guide consumer action, have a self-directed nature (they include an embedded motivational element) as well as a social nature (they are enabled and guided by the external environment)" (Galalae, Kipnis and Demangeot, 2020, p 161). The social nature of dispositions makes them an appropriate tool for capturing the cultural factors behind consumption behaviours in the context of sustainability. Therefore, this construct captures all the desired aspects of the cultural-cognitive pillar since, being reliable, dispositions also meet the institutional requirement of stability (Chaney and Slimane, 2014) and being able to inform and guide consumer behaviour, they are coherent with an institutional theoretical understanding of consumption. Therefore, for the purpose of the present research, Galalae, Kipnis and Demangeot's (2020) definition is adapted to the context of sustainable consumer behaviour as follows: **Dispositions for sustainable consumption (DSC) are reliable latent tendencies that inform and guide sustainability-oriented consumer behaviour, have a self-directed nature (they include an embedded motivational element) as well as a social nature (they are enabled and guided by the external environment)**.

Consumption dispositions have been conceptualised as more orientational (global) and more attitudinal (local). Attitudinal dispositions can be considered subordinate to orientational ones in that they will influence behaviour more directly, but less broadly, than their orientational counterparts. Like attitudes, attitudinal dispositions are more context and time specific, and more immediately significant in explaining specific actions, provided contexts align. The more orientational perspective on dispositions is more closely related to the construct of values, due to their decreased significance, paired however with increased stability across contexts and time (i.e. reliability), in explaining behavioural outcomes. The latter aligns best with the definition used in this conceptual framework since the focus of the definition is on sustainability oriented consumer behaviour in the broad sense – hence incorporating heterogeneous types and forms of behaviour as long as they can be considered to positively influence sustainability.

dispositions toward sustainable consumption imply a tendency to make sustainability-oriented considerations in arbitrary decision making settings, hence resulting in behavioural effects. However, in the context of the intentions-behaviour relationship embodying the cognitive process of interest to this research, dispositions toward sustainable consumption are expected to operate at the stage of forming behavioural intentions. Much like in the Theory of Planned Behaviour, where attitudes are taken to affect behaviour through their effect on intentions formation. Dispositions toward sustainable consumption are culturally informed and represent a more general and stable construct than attitudes, thereby making them central to this conceptual model. While attitudes are not explicitly considered empirically, the role of dispositions is expected to be structurally similar. In other words, dispositions toward sustainable consumption are to be considered to affect behaviour through their effect on the formation of intentions. Moreover, since higher dispositions toward sustainable consumption imply an enhanced tendency to make pro-sustainability considerations, it is natural to expect that the effect should be positive. As a result, the following is hypothesised:

Hypothesis 5: *Dispositions toward sustainable consumption positively influence behavioural intentions.*

In Section 3.2.2 it was explained that according to the principle of abstraction bias, it is abstract attributes of the behaviour that dominate decision making when the behaviour in question is framed in abstract terms. The conceptualisation of dispositions toward sustainable consumption being more orientational (global) than attitudinal (local), leads to the theoretical expectation, based on abstraction bias, that dispositions toward sustainable consumption will more strongly influence more abstract framings of intentions, relative to more concrete ones. That is, in line with the concept of abstraction bias (Section 3.2.2), abstract representations of behaviour rely more significantly on values, morals, and other general considerations. Dispositions toward sustainable consumption are more closely related to values than attitudes, given their global nature and stability. Therefore, it is not generally expected for dispositions toward sustainable consumption to be an equally significant predictor of intentions regardless of the abstraction of their framing, but for the relationship to strengthen as abstraction increases. This stems directly from how abstraction bias operates by relating abstract framings to general attributes of behavioural mental representations, of which dispositions toward sustainable consumption can be considered part. This idea is expressed in the following hypotheses:

H5a: *The effect of dispositions toward sustainable consumption on intentions is stronger the more abstract their framing.*

It follows from the above hypotheses and H2a that the effect of dispositions toward sustainable consumption on behaviour is positive or zero. Since it is hypothesised that dispositions toward sustainable consumption relate more strongly to abstract framings of intentions, and according to abstraction bias this would be expected to enlarge the gap between intentions and behaviour, the total effect is expected to be either positive or non-significant, which can be condensed into it being non-negative, and to be mediated by intentions of more abstract framing (i.e. H5 and H5a above). In other words it is hypothesised that:

Hypothesis 6: *The total effect of dispositions toward sustainable consumption on actual behaviour is non-negative.*

It remains to consider if and how dispositions toward sustainable consumption relate to psychological distance. High dispositions toward sustainable consumption imply a tendency to consider and care about the environment, leading to higher conscientiousness with regards to environmental issues such as climate change, making them capable of reducing the associated psychological distance. According to Construal Level Theory, greater psychological distance leads to more abstract mental representations, and vice-versa (Trope and Liberman, 2010). Along these lines, increased dispositions toward sustainable consumption can lead to more concrete representations of climate change, hence reducing psychological distance from it. In doing so, by Hypotheses 3 and 4, this has an effect on intentions. Therefore, the effect of dispositions toward sustainable consumptions on intentions is expected to take place partly through psychological distance, i.e. a mediation relationship, formulated into the following hypotheses:

Hypothesis 7: *Psychological distance to climate change mediates the effect of dispositions toward sustainable consumption on intentions.*

H7a: *Psychological distance to climate change negatively predicts intentions.*

H7b: *Dispositions toward sustainable consumption negatively predict psychological distance to climate change.*

The following section completes the institutional theory perspective by providing the operational definition of institutional setting employed hereby.

3.4.5 Institutional setting: The normative, regulative pillars of institutions and behavioural drivers

Institutional setting is a complex concept which may refer to a large number of specific constructs, and their interactions (Farkas, 2019). The conceptualisation of institutions typical of the game theory literature on strategic games, which forms the basis for much of the research in behavioural economics, views institutions as a consequence of both the presence of objective rules, and of rules that emerge as a result of social interactions (Binmore, 2010). Institutions are thought to constitute elements of the game's setting, including social interactions, affecting its core elements in ways capable of systematically influencing behaviour. Institutions may extend the strategies available to individuals, vary the quality and quantity of information available, and other elements of the behavioural context like what others do and how individuals interact, just like in the real world (outside the game) (Pénard, 2008). This Thesis strives to observe behaviour directly rather than rely on self-reports as a means to address the methodological shortcomings characterised by the intentions-behaviour gap (see Section 2.6.1). Therefore, strategic games which are often used to model behaviour theoretically and observe it in the lab by means of experiments, constitute a particularly relevant research context here (Ambrosino, 2013).

Within the conceptual context of institutions and strategic games, elements that are external to individual decision-making and behaviour, but affect them in a systematic way, can be considered part of institutional setting (Ambrosino, 2013). In the language of institutional pillars, this naturally includes legal and regulative frameworks, along with social norms, values and morals, surrounding agents' behaviour. However, infrastructure, information and other contextual resources which may aid or hinder decision-making are also part of institutional setting since they emerge within, and serve, the institutional order to which they contribute (Pénard, 2008). Therefore, they can be understood as necessary drivers of institutional legitimisation and change. However, the lack of a behaviour or behavioural pattern does not always mean the absence of the right institutional forces, as legitimisation does not generally occur immediately but over time. Legitimisation goes from minor acceptance to full legitimisation, going through intermediate steps of acceptance along the way (Lawrence, Winn and Jennings, 2001). Therefore, despite the existence of certain drivers, it may be that due to the delay between implementation of the drivers and legitimisation, institutional setting has yet to reach its full potential in terms of both feeding off and exhibiting full legitimacy of sustainable consumer behaviour (SCB). This requires that institutional setting is considered at a continuum

level, such that it can bring about different levels of adoption of a given behaviour, in line with the understanding of SCB as continuous, offered in Section 3.4.1. Such an understanding is facilitated by the definition that follows.

Formally, institutional setting is hereby defined as **the physical and cognitive resources (e.g. infrastructure, information, rules, norms) which enable the influence of regulative and normative institutional forces on individual behaviour.** This definition has several benefits in terms of both conceptual rigour and practical utility. First, it highlights that while changes in legitimacy are necessary, there are practical steps (resources or drivers) that are necessary for this legitimacy to arise. Second, the definition implicitly regards what is hereby referred to as contextual (physical and cognitive) resources or drivers, such as quality of information, infrastructure and norms; as both a consequence and an enabling mechanism of the influence of more abstract institutional forces on behaviour. They are nothing but concrete manifestations of the institutional setting within which they arise. Since these contextual resources are more concrete and palpable, they are easier to conceptualise and measure than institutional forces themselves. Hence, this definition of institutional setting is not only theoretically precise, but also practically useful for empirical research.

The existence of an institutional setting which facilitates the adoption of more SCB is by definition expected to increase the adoption of said behaviours. Simultaneously, institutional setting is not only important in order to facilitate SCB, but is in fact partly necessary for such behaviours to begin to emerge systematically, hence signalling legitimisation. Some important institutional setting elements include quality and quantity of information, the lack of competing goals, and the normative context embodied for example by the behaviour of others. Their status as *necessary* has an important implication. Not only can the existence of the right institutional setting drive greater adoption of SCB, but the lack of the right institutional setting may hinder it. Let us assume that an ideal institutional setting exists, even if hypothetically so. The **ideal case** is defined as an institutional setting which fulfils all necessary conditions for SCB to arise, and also maximises its potential to drive SCB. The following propositions are developed using the concept of an ideal institutional setting as a point of reference for the assessment of arbitrary institutional settings:

Proposition 1: *Institutional settings vary in their degree of alignment with an ideal case.*

Proposition 2: *Different components of institutional setting may contribute positively or negatively to its alignment with an ideal case.*

Proposition 3: *The effect of a given component of institutional setting on the adoption of sustainable behaviour, is proportional to its contribution to the setting's alignment with an ideal case.*

These propositions are theoretical statements that provide a framework within which general hypotheses can be constructed (see Section 3.4, p. 63). How does an institutional setting component's contribution to the alignment of institutional setting to the ideal case contribute to behaviour? This may appear as a trivial question, since, by definition closeness to the ideal case is expected to result in greater SCB adoption. However, the nuance lies in that what the ideal case *is,* is unknown. This opens the possibility for a two directional approach. On the one hand, one could make theoretical predictions about what the ideal case might look like, and use this to empirically assess its hypothesised components. On the other hand, the ideal case may be taken as an unknown, and empirical contributions can be made to elucidating its characteristics, by considering separate components of institutional setting.

Specific hypotheses are developed in the next chapter, where the operationalisation of institutional setting is introduced. This requires design and selection of the specific institutional setting components to be measured and assessed. The hypotheses are presented here, in Table 6, for reference and clarity. However, they are not discussed in more detail until the specific elements of institutional setting to be measured are introduced in Chapter 4 (p. 112).

Hypotheses 8 and 9, shown in Table 6, refer to differences in the physical setting that surrounds consumer behaviour. Next, Hypotheses 10 and 11, make reference to the dynamic element of institutional setting that are social interactions, in this case through consumption from a common pool resource. While both physical and social setting are important, they may not be sufficient even when their potential is maximised. Institutional setting still pends interpretation by individuals, making the degree of its success in driving SCB still dependent on internal individual factors. In other words, individuals' psychological/demographic profile may interact with elements of institutional setting in driving or hindering behaviour. This is the concept to which Hypotheses 11-13 refer. Moreover, as proposed throughout this Thesis, institutional setting plays a crucial role, and failure to account for it is at least partly responsible for the intentions-behaviour gap (IBG). Hypotheses 14-16 have to do with the idea that omitting institutional setting (hence unobserved variance) is expected to lead to overestimation of the effects of psychological and demographic factors on actual behavioural outcomes.

#	Hypotheses about elements of institutional setting in the experiment
H8	Better information quality positively influences adoption of sustainable behaviour.
H9	The effect of resource size on adoption of sustainable behaviour depends on whether it is considered abundant or scarce.
H9a	Resource abundance negatively influences adoption of sustainable behaviour.
H9b	Resource scarcity positively influences adoption of sustainable behaviour.
H10	Collective consumption levels positively influence individual consumption levels within the group.
H11	Others' consumption level negatively influences individuals' consumption levels.
H12	Others' consumption level negatively influences individuals' consumption levels more for individuals with greater dispositions toward sustainable consumption, relative to lower scoring ones.
H13	Others' consumption level negatively influences individuals' consumption levels more for individuals that are less psychologically distant from climate change, relative to more distant ones.
H14	The effect of intentions on the formation of behavioural outcomes is sensitive to changes in institutional setting.
H15	The effects of psychological and demographic factors on behaviour are significantly sensitive to changes in institutional setting.
H16	Failure to account for institutional setting results in the overestimation of the significance of the effect of psychological and demographic variables on sustainable behaviour.

Table 5. A summary table of hypotheses about elements of institutional setting. Variables that quantify specific elements of institutional setting in this research depend on research design and data collection methods which are provided in the methodology, Chapter 4. Note: Under the quantitative conceptualisation of consumption adopted in this Thesis, *more* consumption corresponds to *lower/less* adoption of sustainable behaviour, while consuming *less* corresponds to *more* sustainable behaviour.

The section that follows critically discusses extant findings on the role of gender in SCB, in the context of the IBG, to develop theoretical hypotheses.

3.4.6 Gender and the intentions-behaviour gap

Gender bears both biological and experiential differences in individuals, leading to important differences with respect to attitudes, values and behaviours (Putrevu, 2001; Bloodhart and Swim, 2020). The literature suggests that gender is an important demographic factor that influences pro-environmental behaviour generally, as well as its predecessors (Kollmuss and Agyeman, 2002; Pinto et al., 2014; Nyarko Ayisi and Krisztina, 2022). Findings are generally stable regarding the results that women show more concern for social matters, environmental protection and

consequences of environmental degradation, and have more positive environmental attitudes and willingness to behave more sustainably (Stern, Dietz and Kalof, 1993; Zelezny, Chua and Aldrich, 2000; Kollmuss and Agyeman, 2002; Fukukawa, Shafer and Lee, 2007; Dhenge et al., 2022; Yang et al., 2022). These differences are partially considered to emerge due to men striving more for self-enhancement and personal success, as well as having generally more self-centred goals, relative to women (Pinto et al., 2014; Lan et al., 2009).

Women have been found to respond more positively to hypothetical environmental policy measures (Nyarko Ayisi and Krisztina, 2022). However, as the authors warn early on in their report, one should be careful about extrapolating these results to actual behaviour. Since they are based on self-reports utilising hypothetical measures, the authors acknowledge that reaching conclusions about actual behaviour is beyond the reach of their data and analysis. This acknowledgement makes the disconnect between research designs and knowledge on actual behaviour apparent. All the results discussed to this point pertain to predecessors of actual sustainable consumer behaviour (SCB). Meaning that drawing conclusions about actual behaviour would require an unscientific leap of faith, characterised by a dismissal of the complex processes and mechanisms that lead to actual behaviour, from these predictors.

In terms of gender differences in SCB specifically, women are thought to be overall more sustainable due to a greater tendency to incorporate private actions that resemble frugality, like reducing water consumption and reusing material goods (Bulut, Kökalan Çımrin, and Doğan, 2017; Bloodhart and Swim, 2020). Moreover, while generally consuming more for the home, women still consume more sustainably when considering that they shop for more people than just themselves, travel shorter distances on average and are less likely to own a personal vehicle or travel (Johnsson-Latham, Sundström and Saar, 2007). These considerations lead to a theoretical conclusion, based on empirical evidence, about the overall impact of one gender over the other. However, the argument and empirical evidence make no reference to any of the predecessors of SCB on which women are systematically found to score more positively, relative to men. The importance of this is made apparent below.

Findings regarding gender differences in environmental knowledge have yet to reach consensus. Some findings suggest that women have less environmental knowledge relative to men (Kollmuss and Agyeman, 2002), while recent findings suggest the opposite (Essiz et al., 2023). Moreover, women have been found to be more concerned about the environment but significantly less proactive in terms of activism (Mohai, 2014). The question of whether men or

women are more sustainable overall is a nuanced, complex and definition-dependent issue. To actually determine who is more sustainable would require extensive analysis based in the Life-Cycle Assessment framework, alone or in combination with other methods of environmental, social and economic accounting (Santagata et al., 2020; Oliveira et al., 2021). However, the disconnect is apparent: On one hand, research focuses on understanding the influence of gender on typical determinants of SCB such as environmental attitudes, concern, and behavioural intentions. On the other hand, the argument for the increased sustainability of female consumers' actions, compared to men, is made completely separate from these constructs.

Therefore, a wider perspective should be taken on interpreting current findings and knowledge, inspired by the recurring theme of this Thesis on the intentions-behaviour gap and its prevalence in sustainable consumer behaviour (SCB) research. While women may report greater environmental concern, values and willingness to make their behaviour more sustainable, and be more sustainable overall at the same time, this has little to say about how, and if, these two facts are related. In other words, the two phenomena may occur independent of, and even compete with, one another. Therefore, there is still ambiguity regarding the extent to which female individuals' enhanced attitudes and intentions lead to more SCB, or whether this happens for other reasons.

Since women show more pro-social values and concern for the environment, it is reasonable to expect women to score higher in dispositions toward sustainable consumption and lower in psychological distance toward climate change. More abstract framings of intentions are closely related to abstract behavioural representations based on values and morals, where females have been shown to score higher relative to males. Finally, female individuals are expected to be more sustainable, in line with their values and intentions, and in line with the argument that male individuals tend to engage in more unnecessarily consumerist practices. Therefore the following hypotheses are laid down:

Hypothesis 17: *Being female predicts higher dispositions toward sustainable consumption, relative to being male.*

Hypothesis 18: *Being female predicts shorter psychological distance to climate change, relative to being male.*

Hypothesis 19: *Being female predicts higher levels of intentions to behave sustainably, relative to being mal*e.

H19a: *The positive effect of being a female, relative to being male, on intentions is stronger the less concrete their framing.*

Hypothesis 20: *The total effect of being female on sustainable consumer behaviour (SCB), relative to being male, is positive.*

A direct implication of these hypotheses, particularly **Hypotheses 19** and **19a**, is that the intentions-behaviour gap may worsen for females, relative to males. Specifically, abstractly framed intentions are expected to evoke abstract behavioural representations, based on values. Employing abstraction bias as guiding theoretical principle for understanding the intentions-behaviour gap, such abstract framings tend to fail to sufficiently explain actual behaviour due to overlooking concrete, practical attributes of the behaviour, which is what more concrete framings can achieve according to abstraction bias. Following this rationale, basing knowledge of gender differences in actual sustainable consumer behaviour primarily on the extrapolation of results regarding predecessors of sustainable consumer behaviour like values, attitudes and intentions implies the assumption that these translate into actual behaviour. Therefore, due to abstraction bias, any such effort is bound to lead to the same overestimation that abstract framings of intentions would, hence worsening the intentions-behaviour gap. Gender relating most strongly to these more abstract framings of intentions, like **Hypothesis 19a** claims, implies a largely indirect effect of gender on behaviour, mostly dependent on abstractly framed intentions and their potential to translate into action. The gender effect on actual behaviour is then expected to be increasingly overestimated the more abstractly intentions are framed. Note that, overall, **Hypothesis 20** still indicates that females are expected to behave more sustainably on average, relative to males. However, abstraction bias suggests this gender difference is likely to be overestimated when basing conclusions about behaviour on values and/or intentions.

3.4.7 Risk aversion

Risk aversion (RA) is an important risk attitude which influences individuals' economic behaviour (Dohmen et al., 2011; Fox, Erner and Walters, 2015). It originally emerges in the context of expected utility theory to describe a specific behavioural outcome that may be observed when individuals are presented with a risky choice. In economics this is characterised by the concavity of one's utility function (Fox, Erner and Walters, 2015). For any risky choice (probability-dependent) there exists a certain choice (probability independent), at least hypothetically, which would bear the exact same expected value. When despite the equal expected value, the expected

utility of the certain option exceeds that of the risky one, the individual described by the resulting concave utility function is considered to be risk averse. Conversely, when it is the risky option that produces more expected utility than the certain one, the individual in question is risk seeking or a risk lover, and their utility function is convex. Finally, when the expected utility matches the expected value, the individual is indifferent between the risky and the certain choices, meaning they are a risk neutral individual whose utility function is linear.

While this is not the conception that this research ascribes to, it serves both historical and illustrative purposes. First, the expected utility perspective talks about risk averse, neutral and seeking individuals. This is equivalent to considering risk aversion as a continuum in which different regions correspond to one of the three aforementioned categories (Lilleholt, 2019). Risk aversion in the classical sense would result when RA>N, neutrality when RA=N and risk seeking when RA<N, where N is defined as the point of risk neutrality.

Second, the introduction of a "certainty equivalent" choice to which a risky option is compared to determine the level of risk aversion, serves solely a defining purpose. A certainty equivalent option is rarely actually available to the decision-maker. Often individuals have to decide between choices which bear more, or less, risk and different stakes (Sabater-Grande and Georgantzis, 2002). Therefore, while the classical definition uses a certainty equivalent choice (often hypothetically) to determine the level of risk aversion, practical applications of the concept to empirical settings require drawing further assumptions, particularly when considering risk aversion as a feature on which individuals can be scored. Understanding risk aversion as a disproportionate (relative to expected values of potential outcomes) tendency to seek certainty is the first step. The argument can then be made that between several risky choices, an individual with higher risk aversion will have a stronger tendency to behave in a manner that approaches certainty than lower risk aversion scoring individuals. In other words, risk aversion is not only defined at the limits, where certainty is put against a risky prospect. It also distinguishes between individuals in the strength of their tendency to prefer the lower risk (the one closest to certain). These two considerations are enough to conceptually position risk aversion more simply as an idiosyncratic tendency to prefer less risk (Fox, Erner and Walters, 2015; Lilleholt, 2019).

Risk aversion, as explained in the above conceptualisation, entails a disproportionately negative valuation of risk (relative to theoretically asserted expected value). In the sense of the behaviour of interest, sustainable consumer behaviour, the risk incurred through consumption is one of the more concrete attributes. Based on Construal Level Theory more broadly, and

abstraction bias more concretely, it follows that concrete attributes become relevant locally but may be non-significant as a behavioural predictor when abstract representations of the behaviour dominate. In other words, risk aversion is expected to be significant provided behaviour is framed such that the risk associated with each available choice is explicitly included in the characterisation of said behaviour. Moreover, provided actions, consequences and setting are made sufficiently unambiguous concretely framed intentions can be expected to be influenced by risk aversion, hence mediating its effect on actual behaviour. Therefore, risk aversion is expected to affect behaviour at the stage of formation of individuals' concrete intentions. Since being less sustainable is associated to increased risk in the system, the following is hypothesised:

Hypothesis 21: *Risk aversion positively influences sustainable consumer behaviour.*

Hypothesis 22: *Concrete intentions mediate the relationship between risk aversion and behaviour.*

H22a: *The mediation effect of concrete intentions in the relationship between risk aversion and behaviour is positive.*

The following chapter addresses the methodological basis and the methods that underpin this Thesis.

CHAPTER 4: METHODOLOGY[4]

4.1 Introduction

The previous chapter dealt with the development of a conceptual framework, through definition of constructs and construction of testable hypotheses. The latter are summarised below in Table 7 for reference. This chapter aims to provide a detailed view of the methodological decisions and methods used in this Thesis' literature review and in testing the hypotheses (Table 7). It begins by introducing the methodology employed in conducting the literature review (Section 4.2), followed by the philosophical stance underlying the methodologies employed (Section 4.3). Research design is also introduced in Section 4.3. Operationalisation of constructs is detailed next (Section 4.4), this includes institutional setting, whose operationalisation is required for the proper introduction of hypotheses surrounding this concept as explained in Section 3.4 (p. 63). To conclude, the research context, data collection strategy and rationale, including experimental protocol and participants are presented in Section 4.5.

#	Hypotheses
H1	Intentions' influence on behaviour is mediated by other intentions that are framed less abstractly.
H1a	The mediation effect of more concrete intentions, in the relationship between more abstract intentions and behaviour, is positive.
H2	More concretely framed intentions have a stronger total effect on actual behaviour than more abstract framings.
H2a	The total effect of any framing of intentions on actual behaviour is non-negative. In other words, it is either positive or non-significant (i.e. not sufficiently different from zero).
H3	The relationship between psychological distance and intentions is stronger the more concrete the framing of intentions.
H4	The total effect of psychological distance to climate change on actual behaviour is negative.
H5	Dispositions toward sustainable consumption positively influence behavioural intentions.
H5a	The effect of dispositions toward sustainable consumption on intentions is stronger the more abstract their framing.
H6	The total effect of dispositions toward sustainable consumption on actual behaviour is non-negative.

[4] Aspects of this chapter have been published by the Thesis author - see Georgantzis Garcia et al. (2022).

#	Hypotheses
H7	Psychological distance to climate change mediates the effect of dispositions toward sustainable consumption on intentions.
H7a	Psychological distance to climate change negatively predicts intentions.
H7b	Dispositions toward sustainable consumption negatively predict psychological distance to climate change.
H8	Better information quality positively influences adoption of sustainable behaviour.
H9	The effect of resource size on adoption of sustainable behaviour depends on whether it is considered abundant or scarce.
H9a	Resource abundance negatively influences adoption of sustainable behaviour.
H9b	Resource scarcity positively influences adoption of sustainable behaviour.
H10	Collective consumption levels positively influence individual consumption levels within the group.
H11	Others' consumption level negatively influences individuals' consumption levels.
H12	Others' consumption level negatively influences individuals' consumption levels more for individuals with greater dispositions toward sustainable consumption, relative to lower scoring ones.
H13	Others' consumption level negatively influences individuals' consumption levels more for individuals that are less psychologically distant from climate change, relative to more distant ones.
H14	The effect of intentions on the formation of behavioural outcomes is sensitive to changes in institutional setting.
H15	The effects of psychological and demographic factors on behaviour are significantly sensitive to changes in institutional setting.
H16	Failure to account for institutional setting results in the overestimation of the significance of the effect of psychological and demographic variables on sustainable behaviour.
H17	Being female predicts higher dispositions toward sustainable consumption, relative to being male.
H18	Being female predicts shorter psychological distance to climate change, relative to being male.
H19	Being female predicts higher levels of intentions to behave sustainably, relative to being male.
H19a	The positive effect of being a female, relative to being male, on intentions is stronger the less concrete their framing.
H20	The total effect of being female on SCB, relative to being male, is positive.
H21	Risk aversion positively influences sustainable consumer behaviour.
H22	Concrete intentions mediate the relationship between risk aversion and behaviour.
H22a	The mediation effect of concrete intentions in the relationship between risk aversion and behaviour is positive.

Table 6. Summary table of hypotheses posed for empirical enquiry, developed in Chapter 3.

4.2 Literature review materials and methods

The literature review presented in Sections 2.1–2.3 and 2.5 first identified a basis of recent literature review articles (last 4 years) through a keyword search, on Scopus, Web of Science and Google Scholar. This contained terms relevant to consumption and the CE in general and low-impact journals (i.e., journals rated lower than 3 or B in the Charted Association of Business Schools or the Australian Business Deans Council, respectively) were excluded. The latter criterion did not affect subject-specific (sustainability, CE and so on) journals and all articles were inspected in further depth for inclusion/exclusion. Having identified these basis articles, snowballing techniques were employed to find the next set of relevant articles from the basis articles' references. The process was then iterated to identify further sources. Specifically this involved the expansion of the database of articles analysed in the review based on the the works referenced in the basis articles, and iterating this process based on the researcher's subjective criterion. This snowballing approach was particularly useful for identifying studies that use different vocabulary to refer to the same (or similar) concepts, which can be a problem when searching for a given set of keywords (Wohlin, 2014).

Stage 1: How is the attitude–behavior (intentions–behavior) gap understood in the existing literature?
"attitud*-behavi*r gap" OR "intentio*-behavi*r gap" OR "attitud* behavi*r gap" OR "intentio*behavi*r gap" OR "hypothetica* bia*"
Stage 2: How does the attitude–behavior (intentions–behavior) gap currently relate to the topic of sustainable/ethical/green consumption or in the CE?
AND
"green consum*" OR "sustain* consum*" OR "ethic* consum*" OR "circular economy" OR "circula* consum*" OR "ecol* preferenc*" OR "CSR" OR "corporate social responsibility" OR "responsible consum*" OR "conscious consum*" OR "pro-environmental consum*" OR "environmental* consum*"

Table 7. Literature search strategy: The sustainable consumption intention–behaviour gap (IBG).

In Section 2.5 the literature search followed a systematic keyword search (see Table 3), in order to identify all relevant literature to the intentions-behaviour gap (IBG) in sustainable consumption and the CE. This method was deemed more suitable here as the narrow scope of the section's focus restricts the use of incoherent vocabulary across studies. Additionally, the

method's benefits in terms of rigor and replicability are also desirable (Grant and Booth, 2009) . The strategy (shown in Table 3) consisted of two stages that were constructed based on the results of the first part of the review, where overlapping streams of research that align with the concept of consumption in the CE were identified, as outlined in Section 3. Furthermore, the terms were searched for in the titles, abstracts and key words of academic papers (both in journals and books) from 2010 onwards by using the Scopus and Web of Science databases. The articles were recorded on 17 June 2020 (n = 151). Duplicates emergent from both databases were removed (n = 93), low-impact journals (i.e., journals rated lower than 3 or B in the Charted Association of Business Schools or the Australian Business Deans Council, respectively) were excluded without affecting subject-specific (sustainability and CE) journals; abstracts were inspected in order to identify the relevant papers for inclusion. Articles whose primary focus was not the exploration or elucidation of elements pertaining to consumption behaviour and psychology in contexts implying ethical or sustainability considerations were excluded in this inspection (n = 77). Finally, after full-text screening remaining articles on the latter criterion, additional articles were excluded while particularly relevant pieces of work identified in the reference lists of the analysed articles were included in the review for completeness. The final sample drawn for analysis comprised n = 56.[5]

The literature identified through the methods described above was subjected to acritical review (Grant and Booth, 2009) in order to identify the current state of the topic and extant research gaps that need to be addressed. The benefits of snowball mapping approaches and a key-word literature search strategy, drawn from typical methods in systematic reviews, are desirable in order to maximize the reportability and replicability of the literature identification stage of the present work. However, rather than a descriptive or quantitative analysis of the identified literature, this review seeks to offer a "diagnostic" of extant research relevant to sustainable consumption and lay down avenues for future research capable of addressing certain shortcomings while correctly characterising consumption in the CE. As (Grant and Booth, 2009; p. 93) explain, "a critical review provides an opportunity to 'take stock' and evaluate what is of value from the previous body of work". Therefore, a critical approach provides the best perspective for this review's purposes by offering qualitative insight on the achievements and pending explorations of the existing literature (Grant and Booth, 2009) .

[5] Appendix H provides the PRISMA diagram for this systematic literature review search and selection of articles to analyse. The review was then updated with relevant articles up to 2024 during Thesis write-up.

4.3 Philosophical stance and research approach

The use of a given research methodology bears an implicit philosophical view of what is real and how reality is characterised, referred to as *ontology*, and a theory about what knowledge is and how it is created, called *epistemology* (Jackson, 2013). In the social sciences, the two most commonly discussed stances are positivism and interpretivism, which can be thought of as end-points on a realist-relativist ontological continuum more generally, but have also important epistemological differences (Basias and Pollalis, 2018; Irshaidat, 2022). On the one end, positivism relies on a realist ontological principle that reality is separate and independent of the observer and their interpretation. However, it goes further to assert that only through objective observation can knowledge about the real world be created (Irshaidat, 2022). Conversely, the interpretivist perspective relies on a relativist ontology where reality not only is influenced by subjective interpretation, but is indeed constructed, by the observer. Along the same lines, interpretivists consider that the only reality there is to create knowledge about is precisely the one constructed by the observer. In doing so, it leaves no meaning for objective observation directly from its ontology, and leads to an epistemology where subjectivity is not only assumed but embraced (Ryan, 2018; Irshaidat, 2022).

4.3.1 Positivism vs. interpretivism: Defining the extremes

Despite the importance of understanding the implications of each of the aforementioned philosophical stances, neither encompasses all of the necessary elements of social reality and its scientific inquiry. This is particularly relevant when aiming to study an essentially contested concept such as the CE, and consumption within it (Mukumbang, 2023; Korhonen et al., 2018; Roth and Mehta, 2002). Accepting a purely relativist ontology like in interpretivism, implies the need to also accept its consequences, which is not always trivial. The classical example of, *does the tree really fall if no observer is there to experience it?*, could be argued against on the grounds that perhaps this relativist ontology actually only concerns social reality. Instead, consider the case of animals and their social interactions, of which we humans are a special case (Cronin, 2012; Tinbergen, 2012). Their social realities must be true beyond social constructivism only requiring conceding that social interactions between animals would take place despite the lack of a human observer to interpret them. Many critical aspects of social reality for humans find important

parallels in animal societies which serve as the basis for developing an understanding about them (Young, Pitkow and Ferguson, 2002; McCall and Singer, 2012; Blanco-Gandía et al., 2015). Accepting a purely interpretivist philosophy would mean accepting that this is not in fact valid knowledge about reality, since it does not rely on the analysis of people's experiences. An interpretivist perspective will therefore lead to the impossibility of observing and investigating the materially real structures which contribute to the manifestation of social reality.

A positivist philosophical stance assumes, not only that objective observation is possible, but also that it is necessary in order to establish the validity of any knowledge to be created (Basias and Pollalis, 2018; Irshaidat, 2022). This is less problematic in the natural sciences, although some might still argue against it from a rationalist perspective and Hume's problem of induction (Jackson, 2019; Henderson, 2022). However, in the social sciences, as the interpretivists (sometimes called anti-positivists) would argue, reality is (at least partly) socially constructed and built through the interpretation of the observer. Indeed, history is a good example of how social reality is perceived and understood from conceptions that emerge in that particular historical and geographic period, hence effectively changing it (Brekhus, 2015). It is therefore particularly difficult to separate the knowledge formed about the real, from the cultural and cognitive tools available to interpret and understand it. It is this aspect of positivism that is rejected hereby, while considering the object of investigation real in the material sense, observation is considered to take place through the lens of the historical, cultural and technological context within which it takes place.

Therefore, this research acknowledges that even positivist-leaning methodology leads to findings and conclusions not free of socially guided and constrained interpretation. In fact, all the interpretations and constructions of the reality that underlie them are a part of reality themselves. The mechanisms and causal processes that conform the object of study are explicitly considered to be real in the material sense, in other words, they are considered to exist independent of observation. However, peoples' experiences and socially constructed interpretations of them (perceptions) are also considered real, influence the quality of knowledge, and, what is more, may well constitute a valid object of scientific enquiry. Moreover, what is considered material reality (independent of observation), interacts with elements of the socially constructed reality. This view is evidenced specifically by one of the research objectives of this Thesis, which is concerned with developing knowledge about the influence of consumers' perception of CE-related

behaviours on their adoption (Chapter 1). Perception, which is largely subjectively constructed, is not just a valid, but an important object of study for this Thesis.

The present research engages in conceptualisation of CE and in addressing the gaps present in findings that dominate the realm of sustainable consumer behaviour (SCB). Therefore, a qualitative approach to literature review was necessary to avoid risking falling into the typical rhetoric that has long perpetuated certain research problems like the intentions-behaviour gap (see Section 2.2). Moreover, the conceptualisation of abstraction bias (Section 3.2.2) relates to a feature of subjective experience and perception, which a purely positivist is unable to deal with. On the other hand, theoretical hypotheses were developed to be empirically tested (Chapter 3). In other words, at the centre of this research lies the interplay between socially constructed reality and the generalisable real causal links relating these to behavioural outcomes. Therefore, a combination of both perspectives is necessary. Hence, critical realism was deemed appropriate to adopt for achieving the aims of this research. The rationale that informed this decision is presented next.

4.3.2 Critical realism and methodological openness

Critical realism is positioned as an alternative to the dominating positivist and interpretivist stances in social sciences research, and exploits elements of both to create new epistemological approaches (Wynn Jr and Williams, 2012; Saunders, Lewis, and Thornhill, 2019). In this sense, it can be understood as a midpoint between positivism and interpretivism. While not completely accurate, this view provides a good basis for introducing the foundations of critical realism. At the heart of critical realism is the notion of a stratified or layered reality with three domains, the real, the actual and the empirical (Bhaskar, 2010; Mukumbang, 2023):

1. **Real:** Exists independent from the observer's interpretation. While containing both the actual and the empirical, it also contains thoughts or hypothetical considerations (i.e. non actualised but real elements) and counterfactuals to actualised events (i.e. real underlying causal laws that fail to manifest themselves locally).
2. **Actual:** Exists independent from the observer's interpretation. It contains the empirical, but also actualised events that are not observed or experienced by anyone (scientifically or otherwise).

3. **Empirical:** Depends on the observer's interpretation and its associated meanings. Constitutes the actualised events of reality that are also experienced by some (human) observer.

This concept of a stratified reality captures critical realism's ontology, i.e. its philosophical theory of being and reality (Crotty, 1998) and contains all the essential elements for understanding its basic implications and arguments.

Epistemologically, critical realism combines the notion from positivism, that there is a universal reality that scientific knowledge can elucidate, with the interpretivist notion of the empirical (what is observed or experienced) as influenced by the social context in which the observer lives and observation takes place (historical, cultural or otherwise) (Saunders, Lewis, and Thornhill, 2019). Consequently, it rejects the positivist view that only what is or can be observed is meaningful (i.e. that the empirical epistemologically equates to the real) and the interpretivist notion of nonexistence of a universal reality governing the structure and organisation of the social world (Irshaidat, 2022). Therefore, while the knowledge that is produced about the real is of a transitive nature across social contexts (in line with interpretivism), the reality that the knowledge is about is understood as stable and intransitive (in line with positivism) (Mukumbang, 2023). This illustrates the intuition that critical realism lives in the mid-point between positivism and interpretivism. The following section discusses the implications of a critical realist stance for the selection of research design of this Thesis.

4.3.3 Research design selection

Positivism relies on the argument that only constant conjunction of events can be observed, and not causal relationships themselves, leading to a strict conception of causality attached to a notion of strict regularities (Stroud, 1978). This refers to commonly observed events or occurrences that take place within a closed or controlled system, more typical of the natural sciences. However, social behaviour and social structures bear complexities and context, that make strict regularities in this sense significantly less likely to occur. A critical realist stance acknowledges the complexities of the subject of study and its context, leading to a different notion of causality. Demi-regularities, which are regularities whose occurrence frequency may be dampened by context and social dynamics, are considered strong enough to infer causality (Downward, 2005; Saunders, Lewis, and Thornhill, 2019). As shown in Table 7, the hypotheses posed for empirical enquiry in this Thesis are predominantly expressed as effects among

constructs. This implicitly requires some notion of causality. From a critical realist standpoint that can be expressed mathematically generally as $Y = f(X_1, X_2 \dots, X_n)$, where the independent variables Xs represent constructs that cause some observable effect Y (Mukumbang, 2023). Then, through enough observation of Y and its causes the functional form can be inferred (Ron, 2002; Singleton et al., 2023).

Critical realism highlights the causal effectiveness of social structures, that are thought to hold generative power beyond that of individuals (Elder-Vass, 2010). Here generative power refers to a potential to causally affect some behavioural or structural outcome. Generative potential may then materialise into mechanisms that have an observable effect, without being themselves directly observable. Therefore, in critical realism, causal mechanisms need to be inferred through empirical observation and conceptualisation (Bygstad, Munkvold and Volkoff , 2016). Through this lens, individual behaviour is understood as the consequence of the interaction between the generative powers of individuals and that of social structures (Bhaskar, 2010). This interaction is also considered to take place in the other direction, such that individuals' generative power can also, through interaction with other generative powers, reproduce or transform relevant social structures (Mukumbang, 2023). This framework bears important parallels with that of institutional theory. In the latter, agent-level behaviour emerges as a result of institutional forces surrounding it, but it is also capable of influencing the institutions from which the forces themselves emerge. Therefore, critical realism is in line with this Thesis' understanding that individual behaviour cannot be entirely understood relying only on internal attributes and mechanisms, since external factors play an important role.

Positivism and interpretivism are usually related to quantitative and qualitative methodologies, respectively (Basias and Pollalis, 2018; Saunders, Lewis, and Thornhill, 2019). The former is deductive, it is based on the formation of hypotheses that are either true or false, first, and the use of experiments and other means (such as statistical analysis) to prove or disprove them. Hence, offering insight into verifiable and generally stable features of the mechanisms that give rise to social reality. Interpretivist qualitative research, conversely, is inductive such that it presumes that there is insight to be drawn directly through the analysis of people's experiences of given situations of interest. In such a way, it elucidates elements of the socially constructed reality surrounding the social mechanism of interest.

Critical realist research is once again "in the middle", being typically abductive, meaning that it combines positivist deductive (from theory to data) and interpretivist inductive (from data

to theory) approaches (Suddaby, 2006). Abductive research will typically utilise known premises to construct testable theories, rather than focusing on generating untested/untestable conclusions (like in an inductive inference, characteristic of interpretivism) or on just the testing of theories (like in a deductive approach, characteristic of positivism) (Yucel, 2018). Retroductive theorising is also considered to be a logic of inference in line with critical realism (Ritz, 2020). It espouses the application of all these principles (induction, deduction and abduction), providing a framework for their application (Mukumbang, 2023). Abduction characterises a type of creative thinking which retroduction requires in order to imagine potential mechanisms behind observed events, and abductive conclusions conform the basis for retroductive inference. As such, retroduction, is closely related to abduction and the two are thought to complement each other (Ritz, 2020).

Different types of abduction benefit critical realist research at different stages (Mukumbang, 2023). Without going into too much depth, as it is beyond the scope of this discussion, some types of abduction that have been conceptualised and illustrate the complementarity to retroduction are: over-coded (hypotheses are obvious based on extant knowledge), under-coded (several potential conflicting explanations), and creative (unique interpretation introducing alternative or competing interpretation) abduction (Dobson et al., 2012). Therefore, retroduction seeks to be adaptive to the subject of study, and in doing so benefits from the strengths of other approaches to logical inference, and in particular abduction. In terms of the present Thesis, the differences between retroduction and abduction are not explicitly evident, instead their overlap is. Rather than using the terms to differentiate between one another, in this research they are used to refer more loosely to an adaptable and inventive framework of logical inference that is characteristic of a critical realist stance. An abductive approach is evidenced in this research, for example, through the choice of a qualitative methodology, prior to testing theory, such that the literature review (Chapter 2) and conceptual framework (Chapter 3) sought the development of new theory through a critical appraisal of extant knowledge (Grant and Booth, 2009). Such methodological openness is particularly relevant for this research given that the CE has been coined an essentially contested concept, and extant knowledge is limited by the intentions-behaviour gap (IBG) phenomenon, which lies at the centre of the conceptual framework and hypotheses posed (Chapter 3), originating partly from a lack of theoretical perspectives (Roth and Mehta, 2002; Carrington, Neville and Whitwell, 2010; Carrington, Neville and Whitwell, 2014; Korhonen et al., 2018).

As shown by the above discussion on abduction and retroduction, critical realism invites both qualitative and quantitative methods as useful in the generation of scientific knowledge (Lipscomb, 2011; Almalki, 2016). Qualitative methodologies (e.g. ethnography) and methods (e.g. interviews, case studies, conceptual-narrative analyses) offer a strong framework for carrying out exploratory research on which to then build testable theories. On the other hand, quantitative methodologies (e.g. survey or experimental research) and methods (e.g. questionnaires) offer the right rigour and replication possibilities for testing such theories (McEvoy and Richards, 2006). Moreover, both qualitative and quantitative routes are capable of capturing elements about social structures, individuals and the interaction of their generative power. Therefore, critical realism favours interdisciplinary research as the only way to capture both the complexity of the empirical, through focusing on the meanings that give rise to perceived reality locally in time and space, as well as the generalisable real structures and mechanisms that underlie observed effects, by focusing on the testing of theories. A discussion on the positioning of the present research within this critical realist philosophy follows.

The present research implicitly accepts the significance of both qualitative and quantitative methods by first critically reviewing the literature and developing a conceptual framework (see Chapter 3) based on existing knowledge from existing quantitative (e.g. De Lanauze and Siadou-Martin, 2019; Frank and Brock, 2019; Wang, 2019; Wang et al., 2019) and qualitative (e.g. Carrington, Neville and Whitwell, 2014; Wiederhold and Martinez, 2018; Zeng and Durif, 2019) studies (Chapter 2). The literature review search stage uses a combined systematic key words and snowballing approach, in order to benefit from the rigour and accuracy they provide, while analysis takes a qualitative critical approach, enabling access to greater qualitative insight. This combination of qualitative and quantitative approaches typical of retroductive theorising and abduction, supports the positioning of this Thesis as a critical realist effort (Mukumbang, 2023). It helps uncover commonly overlooked problems of the sustainable consumer behaviour (SCB) literature, while mitigating the risk of just perpetuating extant gaps (Grant and Booth, 2009). The methods used in the literature review are covered in detail in Section 2.2.

The intentions-behaviour gap (IBG) phenomenon can be considered the backbone of the conceptual framework developed in Chapter 3. This is evident from the focus on the intentions-behaviour relationship shown by all the hypotheses developed in this Thesis (see Table 7). The context of the IBG is instrumental to addressing the objectives of this Thesis and contribute to the

literature on SCB. The potential for both methodological and theoretical origins of the IBG is still a matter of debate as discussed in Section 2.5. Therefore, only by making theoretical and methodological considerations together can one hope to appropriately contribute to its understanding. Methodological biases need to be addressed in order to reliably study the phenomenon. The most apparent methodological innovation is that behaviour should be observed, not reported by participants, hence avoiding potential response biases. As explained in Section 2.6.1, the context of laboratory experiments in economics offers a particularly relevant methodological framework for addressing this in a controlled manner. Not only is behaviour observed and incentive compatible, but context (i.e. institutional setting) can be designed into the experiment and directly measured. The closeness of the conception of SCB built hereby with the context of common pool resources and social dilemmas (see Section 2.6.1) makes this methodological approach particularly relevant.

On the other hand, measuring self-reports of intentions, psychometric and demographic factors is necessary to address all the hypotheses developed in the previous chapter (Chapter 3). It is not just an issue of observing behaviour, but uncovering how doing so affects its relationship to other relevant constructs. Additionally, to ensure that the results are comparable to extant research, an analytical framework with some structural similarity is desirable. Therefore, the goal is to marry the behavioural-economic approach to measurement of behaviour and institutional setting through experimental design, with the operationalisation of latent psychological factors that characterises quantitative survey research in psychology. This addresses the methodological shortcomings leading to the IBG, as well as extending the analysis by means of a methodologically interdisciplinary synthesis of psychometric and econometric analyses. Quantitative methodologies are legitimate in critical realist research on the grounds of rigour and accuracy, which are desirable in theory testing based on the identification of demi-regularities denoting a critical realist notion of causality (McEvoy and Richards, 2006).

With this in mind, empirical enquiry of this Thesis adopts a mixed quantitative approach combining experimental and survey data. The former, grounded in experimental economics, provides the means to observe behaviour, and changes in institutional setting, without relying on self-reports. Simultaneously, the survey allows for the measurement of psychological factors that cannot be otherwise observed. The survey is incorporated into the experiment to ensure compatibility of experimental and survey data, by minimising within-individuals random variation. These research design decisions are in line with this Thesis' focus on addressing both

methodological and theoretical research gaps that manifest through the IBG - evidenced by the three actions introduced in Chapter 3 (Table 5, p. 60) to align the research objectives of this Thesis to the results of the literature review (Chapter 2) - while explicitly accounting for the importance of understanding context.

Data analysis contains two steps and analytical frameworks, the first being a structural equation modelling (SEM) approach reported in Chapter 5. This is considered a deductive approach that relies on theory testing, which is in line with the efforts to develop testable hypotheses carried out in Chapter 3 (Brown et al., 2021). In particular, many of the hypotheses relate to a specific structure of mechanisms of causation about psychological factors which in combination ultimately lead to a behavioural outcome. Some examples are *H5: Dispositions toward sustainable consumption positively influence behavioural intentions* and *H2a: The total effect of any framing of intentions on actual behaviour is non-negative. In other words, it is either positive or non-significant (i.e. not sufficiently different from zero)*. These are particularly well suited to SEM which facilitates the modelling of such a network of simultaneous causes and subsequent empirical testing of its validity and reliability, as tokens of its fidelity in representing objective reality.

The second framework is that of regression analysis, adopted by means of a mixed effects model which aligns best with the nested data structure characteristic of the experimental data collected, as reported in Chapter 6. This approach may be considered more inductive in nature, such that it is more oriented toward the identification of unknown mechanisms, particularly about institutional setting, than testing a specific causal structure (Ron, 2002). However, in the present research, hypotheses were still developed to this end (Table 7), such that it is more abductive in that data was also collected based on theory, rather than extracting theory from arbitrary observation. As a result, this analysis attempts to both test extant understandings, and uncover new unknown mechanisms by which actual SCB takes place or not. As a result, some of the hypotheses are of a different nature as they are not about a specific causal link, but about how institutional setting interacts with psychological and demographic factors to give rise to behaviour. For example, *H16: Failure to account for institutional setting results in the overestimation of the significance of the effect of psychological and demographic variables on sustainable* behaviour and *H14: The effect of intentions on the formation of behavioural outcomes is sensitive to changes in institutional setting*. While others are more in the usual style concerning specific effects, e.g. *H9a: Resource abundance negatively influences adoption of sustainable*

behaviour. In this way, the regression analysis also offers a further appraisal of hypotheses tested through SEM, by considering them relative to the influence of institutional setting.

In sum, the adoption of a critical realist perspective, leads to a methodological openness characterised by retroduction and abduction, which allows for a combination of quantitative and qualitative methodologies to coexist and interact. Empiricist objectivity is still regarded as an ideal for which any effort to test hypotheses should strive, despite accepting its dependence on interpretation. However, seeing the generative power of social structures, also calls for qualitative methodologies that delve deeper into socially constructed reality and context. In this Thesis, a systematic search and qualitative critical-narrative approach are employed at the first theory development stage, as shown in Chapters 2 and 3. A mixed survey-experiment quantitative methodology is adopted in data collection, and a combination of deductive (structural equation modelling, i.e. SEM) and inductive-abductive (regression) approaches are employed in data analysis. The deductive (and abductive) element relates to hypothesis testing, which can be identified in both types of analysis. The inductive element makes reference to the use of regression analysis, which is usually a data-to-theory approach. However, in this case it bears a dual role of theory testing and identification of unknown mechanisms behind SCB, making it better characterised as an abductive.

The following section provides a description of the experiment that was designed in line with the research design presented above.

4.3.4 The Armageddon game: An experiment about sustainable consumption

To observe behaviour, an experiment was designed such that the incentives and framing that are representative of the situation of interest are appropriately reproduced. In this case, that is consumption leading to increased risk of a catastrophic future outcome, due to resource deterioration or more generally perturbation of the ES, when carried out at unsustainable levels. The characterising elements of this situation inspire the development of a new kind of common pool resource extraction game (Camargo and Haydu, 2016; Tisserand et al., 2022; Herne, Kuyper and Lappalainen, 2023). This Thesis calls this *The Armageddon Game* (AG)[6]. By assigning real monetary returns for participants based on the outcomes of the game when played under laboratory conditions, the AG serves as a basis for creating incentives representative of the

[6] Please refer to Appendix A for a detailed description and mathematical formulation of the Armageddon game.

situation of interest, i.e. sustainable consumer behaviour (SCB) (Cummings et al., 1997; Zawojska and Czajkowski, 2017). More precisely, this creates a tool for the observation of behaviour that is representative of decision making under incentives present in real life, hence overcoming the limitations associated with self-reported measures of behaviour.

The game has features of a common pool resource game but is adapted to a dynamic and probabilistic setting, which are critical features of environmental and resource degradation due to unsustainable human-economic activity (Abbass et al., 2022). Since all real consumption takes place within the Earth system (ES), everyone benefits from its existence. In the real world, everyone benefits equally from the ES's existence regardless of whether their decisions have contributed more to its continuation or extinction (in line with the common pool resource paradigm). In the game, this translates into the probability of the ES's survival in the future representing the collective benefit or public good.

A probabilistic setting has been used to take environmental issues to the lab in a common pool resources context (Palm-Forster and Suter, 2022). However, Palm-Forster and Suter's (2022) experiment bears important differences with the present one as it is based on a tipping point of resource depletion, beyond which a catastrophic outcome may occur, focusing on attitudes toward uncertainty (as their treatments show). In the present case, the focus is rather on replicating the interaction between micro-level behaviour and macro-level consequences. Given the context of sustainable consumption, players interact with the common fund by consuming its tokens. The tokens collected by each player will determine their individual profit, while the size of the common fund will determine the probability of survival for the world. In other words, the probability of the world ending is a continuous feature of the game unlike in Palm-Forster and Suter's (2022). Hence, players have a purely individual incentive to maximise their consumption, opposed by a collectively shared incentive to maintain the probability of survival of the world at a high enough level. Therein lies the social dilemma faced by players, as required by the situation of interest. An in-depth description of the game and the parametrisation employed in the experiment are provided in Appendices A and B.

4.3.5 Validity and reliability: Considering rigour

As explained throughout the above discussion, quantitative methods in critical realist research strive for rigour in the identification of mechanisms behind observed effects. This requires explicitly considering the issues of validity and reliability, as explained in more detail below.

Reliability

A measurement or research procedure is reliable when it minimises random error (Bajpai, 2014). This latter refers to deviations from true values that follow no systematic observable pattern. This means that their application, assuming a reliable procedure, will have stable and homogeneous consequences across and within contexts. These random errors can emerge on two fronts, application of methods, or instability in construct equivalence between segments of individuals; for example when different understandings exist between cultures. The main attributes of reliability are internal consistency, stability and equivalence (Heale and Twycross, 2015). Internal consistency refers to the extent to which a set of measurement items capture a single construct. Stability refers to the consistency of outcomes when the same procedure is applied a second time. Equivalence refers to consistency of responses of different individuals, or between measures of sufficiently similar constructs. Method bias, refers to random errors that arise as a result of sampling, features of the instruments or the way in which they are administered. Construct bias refers to random error due to a lack of equivalence of a construct between types of respondents who differ, for example culturally. Methodological decisions aiming to increase reliability of this research are summarised below, organised according to the type of bias they make reference to, method or construct:

1) Method bias:
    a) Laboratory experiment: By conducting data collection for both the experiment and the survey in a controlled laboratory environment, the potential for method bias is mitigated significantly. Compared to typical online surveys, and other data collection methods where participants are crowdsourced online, laboratory experiments can reduce random error in the data (Brühlmann et al., 2020; Uittenhove, Jeanneret and Vergauwe, 2023).
    b) Incentive compatibility: Experiments rooted in economics employ real monetary incentives, designed into experimental design to replicate incentives in the situation of interest. This greatly enhances reliability by ensuring that what is observed through this research process is representative of actual phenomena (Carson and Groves, 2007; Zawojska and Czajkowski, 2017; Hackethal et al., 2023). Incentives designed into the experiment ensure the emergence of the social dilemma characteristic of the context of sustainable consumer behaviour (SCB). Since the outcomes of the experiment bear real monetary consequences for participants, they are more compelled to focus on realistically interacting with the incentives through their decisions and behaviour. Therefore, this feature significantly reduces the potential for random error to be introduced due to lack of interest, and lack of incentive compatibility overall.

c) Participant recruitment: Participants were recruited using the subject pool an established experimental economics laboratory operating within a public university in Castellon, Spain (Laboratori D'Economia Experimental, Universitat Jaume I). This has various benefits in terms of reducing method bias. First, it is worth noting that the complexity of the issue of SCB, and the conceptual framework developed, evidenced by the large number of resulting hypotheses (Table 7), requires the design of a complex experiment (Section 4.3.5). To this end, members of the laboratory subject pool are generally used to participating in experiments rooted in experimental economics. This enhances their capacity to understand rules and nuances, and consequences, of the experiment. Hence decreasing the space for random error to arise as a result of poor understanding and further increasing incentive compatibility. Moreover, the subject pool used is comprised primarily of students, which homogenises the socio-demographic profile of the sample removing potential confounding effects due to random error from such differences (Gächter, 2010; Druckman and Kam, 2011). This is particularly helpful in the context of a novel experimental design. Participant sampling was not restricted to include only students, but the resulting sample was student-dominated, while still including a greater portion of students who had completed undergraduate studies at the time of the experiment (Section 4.5.3).

d) Instruction comprehension test: An instructions comprehension test was put forward between the reading of instructions and the start of the experiment. The test was multiple choice and the options provided covered several potential misconceptions that could arise from the complexity of the instructions. Most of these were based on conversations with participants of the pilot who informally offered relevant points from their point of view. Rather than scoring individuals on the test to establish comprehension, which could enhance anxiety, participants were allowed to try unlimitedly, but were required to succeed in order to go through to the actual experiment. The time taken for each participant to complete the instructions comprehension test was measured as proxy for participants' understanding of the game.

    i) The dynamics through which consumer behaviour interacts with the global scale in the context of sustainability are complex and rarely understood precisely by consumers. The complexity of the experiment, which is in fact a lot simpler than the micro-macro dynamics between individual behaviour and environmental impacts, provides a realistic representation of the situation of interest while bounding its complexity to a finite and manageable number of parameters. However, a complete lack of comprehension can lead to random error to emerge which if significant enough can lead to influential cases. Therefore completion times of the instructions comprehension test were explored against univariate and multivariate outlier cases. No effect was found from high completion times on the likeliness of exhibiting outlier behaviour. In fact the p-values were 0.77 and 0.88 for the cases of multivariate and univariate outliers, respectively, and often with a reverse sign implying that smaller times increased the probability of being an outlier. Given its prominent lack of significance it was excluded from the models that were ultimately reported in the

outlier analysis shown in Appendix C. This suggests that the test may have well enhanced comprehension, since taking longer to understand did not result in increased likeliness of unreasonable values relative to overall behaviour observed in the experiment. Most importantly, no support was found for the hypothesis that random error may arise from a lack of understanding by participants.

e) Outlier analysis explored, among others, the potential role of lack of understanding (i.e. extreme values of time to complete the instructions comprehension test) which was found to not be significant (see Appendix C).

f) Sampling and gender quota: Participant sampling was done at random within the laboratory's subject pool, and within imposed gender quotas, such that each experimental session had comparable representation from both genders. This is not random sampling from the population but the restriction to a student-dominated sample is in fact a desirable feature. On the other hand, the quota imposed on gender constructs a more realistic sample on which gender effects can be reliably assessed. This is important in light of the prominence of gender effects on SCB (Kollmuss and Agyeman, 2002; Pinto et al., 2014; Nyarko Ayisi and Krisztina, 2022). The risk of non-imposed quotas to lead to influential cases that might increase random error was mitigated through an identification and analysis of outliers. The results showed that the only demographic variable exhibiting outlier values, age, had no relation with being an outlier behaviourally (Appendix C).

g) Matching groups: Experiment participants are matched into groups of 4 prior to their engagement in the experiment. The matching groups were randomly determined by random seat allocation by laboratory staff on entry, with the only restriction to ensure equal representation of both genders between treatments in the experiment. This on the one hand reduces potential bias due to self-selection within matching groups, while on the other it ensures the viability of reliably exploring gender effects.

h) Combining experimental and survey data: The use of an experiment significantly reduces the potential for biased results. Surveys have been found to fall prey to common method bias due to the typical homogeneity with which they extract information. On the other hand, experiments are more experiential and measurable elements change beyond the control of participants. Therefore, they incorporate various types of information extraction. This research design is such that data on the dependent construct of SCB and the independent institutional setting are observed experimentally, while other independent predictors measured through a survey questionnaire. This reduces common method bias which arises when the dependent and independent variables are measured through similar elicitation or inference methods, leading to inflated correlations. It is worth noting that this increases reliability of both the experimental and the survey data alike. The experiment offers an alternative mode of observation which ensures incentive compatibility, hence enhancing the reliability of observed effects by removing common method bias. Simultaneously, survey data enriches experimental data by also offering an alternative approach to measurement, hence submitting observations and conclusions to greater scrutiny.

i) Pilot experiment: A pilot experiment was carried out in order to confirm and adjust the parametrisation of the experiment based on preliminary application of the experiment. As a result, matching group size was reduced from 5 to 4, in order to ensure an increased number of group-level observations with the same sample size. Hence, the sample size was more efficiently used to ensure that parametric statistics can be reliably applied. Some other technical changes were made to the programme based on subsequent conversations with several participants. Additionally, this provided researchers and laboratory staff with experience about potential challenges in the implementation of the experiment such as reading of instructions, order of steps of data collection (survey-experiment-survey), match making, and dealing with COVID-19 restrictions. The effects of these challenges was significantly mitigated in the actual experimental sessions due to the experience that had been acquired by means of the pilot.

2) Construct bias:

a) Matching groups: Experiment participants are matched into groups of 4 prior to their engagement in the experiment. It is between these groups that institutional setting differences are enabled to happen. Having matching groups creates many largely randomly determined settings in which individual behaviours are then observed, such that regularities can be more reliably ascertained provided setting dynamics are controlled for in statistical analysis, like it is the case in this experiment.

b) Dynamic experimental design: Rather than observing a single decision of behaviour to infer conclusions about individuals, the experiment designed incorporates a concept of discrete time. This allows for repeated measurement of behaviour within subjects, and in a changing setting whose dynamics can be explicitly controlled in statistical analysis. Therefore, random error in the process of measuring behavioural outcomes and effects of setting is significantly reduced.

c) Exploratory measures and pilot study: The measurement of intentions of high concreteness was addressed by designing a short survey instrument into the beginning phase of the experiment. It preceded reading of experimental instructions, such that the exact experimental setting was unknown. The instrument first introduced a description of the experimental setting with special impetus on the incentives present. Since this is highly specific to this experimental context, extant measures could not be used. Therefore, the items incorporated in this instrument were designed exploratively to cover a wide range of issues and wordings around intentions. The pilot experiment included these items and subsequent comparison to the factor structure employed in confirmatory phases of analysis (Chapter 5), was reproduced to a great extent, in terms of factor loadings and communalities, by EFA of the pilot items. This points towards a lack of construct bias and supports reliability through stability of the results.

d) Existing reflective scales: Where possible, validated reflective measurement instruments were employed to minimise random error. These included adapted measures of intentions, a widely validated measure of dispositions and a previously applied measure

of psychological distance which was deemed superior to alternatives by previous research.

e) Preliminary and confirmatory analyses: Measurement instruments and items were examined thoroughly for dimensionality, factor structure and validity through preliminary factor and regression analyses. This resulted in the removal of poorly performing items, such as reverse-coded items in the psychological distance scale and positively-framed intentions referring to the experimental setting. The resulting factor structures were subsequently confirmed thoroughly following standards of psychometric measurement and structural equation modelling (Chapter 5).

Further, reliability considerations also concern statistical analyses and interpretation of results. In order to make such assessments explicit, the analysis conducted in Chapter 5 offers a detailed account of considerations made about model fit, convergent, discriminant and nomological validities. In particular, the latter is primarily assessed through testing the theoretical hypotheses. In Chapter 6, the mixed effects model is introduced in order to account for data nesting. Moreover, the fundamental assumption of such models, that the random part is uncorrelated with the residuals, is explicitly addressed by inclusion of cluster means. Statistical techniques for model comparison such as Likelihood-ratio tests, F-tests and Akaike and Bayesian information criteria are used to refine the formulation of the model.

Validity

Validity refers to the level of accuracy of a given instrument in capturing the construct it is trying to measure (Netemeyer, Bearden and Sharma, 2003). In other words, rather than random, validity is concerned with the avoidance of systematic errors. The main attributes of validity are content, construct and criterion validity (Heale and Twycross, 2015). Content validity refers to whether a measurement instrument covers all defining attributes of the construct being measured. Construct validity refers to the ability to correctly infer the idiosyncratic profile, relative to the construct of interest, of the subject to which measurement corresponds. Finally criterion validity refers to the ability of an instrument to appropriately relate to other constructs of similar meaning.

Content validity was primarily addressed through a thorough process of developing operational definitions of constructs (Chapter 3). These are definitions that simultaneously characterise the construct of interest precisely, while offering enough specificity for measurement to be well defined. For example, the operationalisation of SCB as a quantitative

extraction from a resource can be deduced directly from the definition, and designed into the experiment, greatly reducing the risk of measuring anything else than what was defined.

Construct validity is addressed explicitly in Chapter 5 by exploring the unidimensionality and model fit of the instruments used. Instruments of intentions originally included more items pertaining to producing less waste. While these were not reliable and valid enough to make it into subsequent confirmatory analysis, preliminary analysis showed its significant overlap with intentions to consumer more sustainably (BISUST), and both of these were found to differ significantly from intentions to consume less (BIRED). These observations are all in line with the discussion offered in Chapter 2, that the meaning of consuming sustainably and consuming less have yet to converge as sustainability requires. Recycling and waste production are more in line with current understandings of sustainability, therefore both their overlap with BISUST, and the separation of these with BIRED shows good convergence and theory evidence of construct validity. As expected theoretically, some skewness is observed in the dispositions and psychological distance instruments, in both cases in the expected direction. That is, there is a tendency to score higher than average on dispositions and lower than average on psychological distance, just like the intentions-behaviour gap (IBG) may have suggested. These are both theoretical expectations which show signs of construct validity.

Criterion validity was demonstrated explicitly in Chapter 5, where convergent and divergent validities are discussed. Moreover, the high rate at which the models developed in Chapters 5 and 6 support the hypotheses laid out in Chapter 3, is an explicit sign of nomological validity, since they relate precisely to making predictions about how constructs relate to future outcomes. This is explained in more detail in Chapter 5.

In terms of external validity of this research, it is significantly enhanced by the combination of both experimental and survey data. It is acknowledged that the sample used is likely not representative of a given national or global population. However, this was never intended by this research as evidenced by the experimental research design. Rather, the goal was to create controlled conditions and incentives compatible with the situation of interest, i.e. the social dilemma attached to SCB (Appendix B). This sought to explore a treatment effect operationalising an element of institutional setting (information quality) and control for other institutional, psychological and demographic variables, while minimising the potential for confounding effects. While on the one hand the lack of a representative sample could be used to argue against the external validity of this research, such criticism is not as relevant to this research design as it may

have been for a survey-only study. Instead it is argued that this was a necessary condition for external validity of the results. While socio-demographic heterogeneity introduced by a representative sample may have an important effect on SCB, a parsimonious statistical analysis cannot hope to control for all factors given a finite sample size. Since the focus of this Thesis goes beyond these effects, a socio-demographically homogeneous sample offers better resolution of identified mechanisms relating to the constructs theorised in this research. This goal is more in line with the objectives of this Thesis than aiming to appropriately represent some real population. On top of that, the sample was assessed for suitability in terms of external validity by explicitly defining the research context in Section 4.5.1.

4.4 Operationalisation of constructs

An important first step in any statistical analysis is the proper definition of the operationalisation of variables (Netemeyer, Bearden and Sharma, 2003). This means translating concepts into measurable parameters that appropriately reflect their definition (Haucke, Hoekstra and Van Ravenzwaaij, 2021). This Thesis, employs a combination of measurement techniques from both psychometric theory, i.e. reflective measurement models (Zhang, Dawson and Kline, 2021), and econometrics, i.e. observation of behaviour and institutional setting through incentive compatible experiments (Chen 2008; Aoki, 2011; Zawojska and Czajkowski, 2017).

Reflective measurement models involve the use of observable questionnaire items to extract the unobservable latent factor corresponding to the construct being measured (Zhang, Dawson and Kline, 2021). This is done through estimation of a set of simultaneous linear statistical models where the latent factor predicts the observed items linearly and separately. This means that the items' shared variance is taken to come from the same latent factor. This is a standard in psychometrics, where researchers typically seek to measure constructs that are not directly observable, such as psychological traits (Kline, 2023). In the model, dispositions towards sustainable consumption (DSC), Psychological distance to climate change (PD) and all behavioural intentions constructs are of this kind, and are measured reflectively. Chapter 5 (Section 5.2) provides the in-depth analysis related to empirically confirming the validity of the measurement model.

Construct	Definition	Type	Source(s)
Intentions to behave more sustainably [(A1)]	**Def:** Self-reported intentions to behave more sustainably in the future. These are the most abstract operationalisation used. Action, setting and outcome are open to interpretation.	Self-reported; Reflective	Adapted from (Li et al., 2018; Si et al., 2020)
Intentions to consume less [(A2)]	**Def:** Self-reported intentions to consume less in the future. These are the second operationalisation in order of abstraction. Only setting is highly ambiguous, while action and outcome are concrete and clear.	Self-reported; Reflective	Adapted from (Li et al., 2018; Si et al., 2020)
Intentions to behave non-sustainably in the experiment [(A3)]	**Def:** Self-reported intentions to behave non-sustainably given a precise description of the experimental setting. These are the least abstract operationalisation of intentions used. Setting and action are concretely presented and mimic exactly the behavioural context of the experiment.	Self-reported; Reflective	Exploratory (see Appendix D)
Dispositions toward sustainable consumption	**Def:** Reliable latent tendencies that inform and guide sustainability oriented consumer behaviour , have a self directed nature (they include an embedded motivational element) as well as a social nature (they are enabled and guided by the external environment) (Adapted from Galalae, Kipnis and Demangeot, 2020)	Self-reported; Reflective	Haws, Winterich and Naylor (2014)
Psychological distance to climate change	**Def:** Perceived distance to climate change in all or any of the spatial, hypothetical, time and social dimensions.	Self-reported; Reflective	Wang (2019)
Sustainable consumer behaviour	**Def:** Behaviour that contributes positively to the sustainability of the resource-generating system in which it occurs.	Observed	Experimental design (resource consumption)
Institutional setting	**Def:** The physical and cognitive resources (e.g. infrastructure, information, rules, norms) which enable the influence of regulative and normative institutional forces on individual behaviour.	Observed	Experimental design (treatment, resource size, and others' consumption)
Risk aversion	**Def:** A tendency to value risk more negatively than expected valuation would suggest.	Hypothetical lottery panels; Mean-based index	Sabater-Grande and Georgantzis (2002)

Table 8. Operationalisation of constructs. All constructs used in empirical analysis are presented in the table. The name and definition/description are provided in the two leftmost columns. The "Type" column represents the type of elicitation and factoring. The "Source(s)" column offers the source of the operationalisation, in the literature or in the experimental design. [(A1)], [(A2)] and [(A3)] depict the level of abstraction of the respective intentions construct, with lower numbers corresponding to higher abstraction levels.

The following sub-sections, explain the operationalisation of all variables and factors used in the statistical analyses conducted in this Thesis. This includes risk aversion, institutional setting and sustainable consumer behaviour (SCB), in addition to the reflectively measured constructs, i.e. intentions of varying abstraction, dispositions toward sustainable consumption, and psychological distance. Table 8 summarises the operationalisation of constructs, by showing their definition, the type of measurement and variable and the sources of instruments.

4.4.1 Dispositions towards sustainable consumption

Dispositions for Sustainable Consumption (dispositions toward sustainable consumption) are defined here as **reliable latent tendencies that inform and guide sustainability oriented consumer behaviour, have a self directed nature (they include an embedded motivational element) as well as a social nature (they are enabled and guided by the external environment)** (Adapted from Galalae, Kipnis and Demangeot, 2020).

As explained in Section 3.4.4, dispositions in a consumption context have been used primarily in the international marketing literature, from which the present research draws its conceptualisation. Therefore, their use has mostly focused on dispositions about inter-cultural phenomena, like the global vs. local nature of products or globalisation, e.g. ethnocentrism, global/local identity or globalisation attitudes (Diamantopoulos et al., 2019). As a result, their use within the context of sustainability is limited. Some measures of dispositional constructs that are available and validated are “sustainability orientation” (SO) (Kuckertz and Wagner, 2010; Sung and Park, 2018) and “consumer environmental predisposition” (Roberts, 1996; Straughan and Roberts, 1999; Raggiotto, Mason and Moretti, 2018). The former is of a general nature and captures idiosyncratic orientations and traits concerning environmental protection and social responsibility (Sung and Park, 2018). However, the operationalisation of the construct is explicitly tailored to the context of entrepreneurship, rather than consumer behaviour (Kuckertz and Wagner, 2010). On the other hand, “consumer environmental predisposition” is measured by Raggiotto, Mason and Moretti (2018) through Roberts’ (1996) instrument of *ecollogically conscious consumer behaviou*r. This focuses on specific behaviours such as the reduction of energy consumption, the purchasing of green products and the effect of reduced environmental impact on preferences. Therefore, it is too behaviourally focused since it was developed to address the behavioural construct, rather than dispositions, in the context of environmental consciousness (Tilikidou, Adamson, and Sarmaniotis, 2002). These avenues toward the operationalisation of

dispositions toward sustainable consumption fail to appropriately characterise dispositions toward sustainable consumption as conceptualised hereby.

Alternatively, within the consumer psychology literature, Haws, Winterich and Naylor (2014) have developed and validated an instrument for what they term *green consumption values*, which they define as "the tendency to express the value of environmental protection through one's purchases and consumption behaviours"(p. 337). The authors go on to describe highly scoring individuals in the scale as being "generally oriented toward protecting resources at both the environmental and personal level". The conceptualisation evidenced by these remarks made by Haws, Winterich and Naylor (2014) contains all important features of the definition of dispositions toward sustainable consumption used here. First, it talks about tendencies, and their stability can be deduced from the term *values*, which the authors coin as part of the construct's name. Next, their influence on behavioural outcomes is made explicit from the definition, without equating it to behaviour itself. Finally, the mention of both the personal and environmental levels at which these tendencies operate highlights both the motivational, self-directed element of dispositions toward sustainable consumption, and their social nature. Therefore, this measure conceptually aligns with the definition of dispositions toward sustainable consumption used here. Moreover, while the items seem more focused on the environmental dimension, the authors run an extensive analysis to establish nomological validity against constructs capturing the social and economic dimensions of sustainability, among others. This supports an appropriate characterisation of sustainability in all its dimensions. This instrument aligns best with the present conceptualisation of dispositions toward sustainable consumption on top of being a rigorously tested and validated 6-item scale. For this reason, Haws, Winterich and Naylor's (2014) instrument was used in the operationalisation of the dispositions toward sustainable consumption construct.

4.4.2 Psychological distance to climate change

The operationalisation of psychological distance from climate change (PD), defined in this Thesis as *the perceived cognitive separation an individual experiences relative to the concept of climate change and its potential and actual effects; on the temporal, spatial, hypothetical and/or social dimensions*, has already received some attention in the environmental psychology literature. Specifically, PD has been explored recently by Wang (2019). The authors adapt, extend and validate Spence, Poortinga and Pidgeon's (2012) measure of PD. The result is a reliable 18-item

measure, identified by the authors as superior in comparison to the 5-item measure of McDonald et al. (2013) which relies on continuous sliding scales. Therefore, the present research employed Wang's (2019) instrument as the foundation for the measurement of PD.

4.4.3 Risk aversion

Risk aversion is often operationalised using monetarily incentivised (lottery) tasks in experimental economics (Hackethal et al., 2023). These tasks aim to differentiate individuals from one another through their choices in abstract tasks or lottery choices. In other words, rather than relying on respondents' interpretation, risk aversion is revealed through behaviour in the task (Lilleholt, 2019). Lilleholt (2019) found 13 different tasks used, in the articles included in their meta-analysis, to measure risk aversion in the context of gains (i.e. risk associated with making profit), 6 in the domain of losses, and 12 in the context of mixed gains-losses.

The most widely used task is the multiple price list (MPL) task (Holt and Laury, 2002). It is usually administered as a list of lottery pairs where the stakes are kept constant while varying the associated probabilities. An example of this test is shown in Table 9. Respondents are asked to choose one lottery from each pair, such that the switching point from one lottery column to the other is a measure of risk aversion. However, the test has received criticism for its assumption that responses will neatly detect a single changing point from one column to the other, while in reality respondents may well defect from this expectation, making the interpretation of several column changes challenging (Barreda-Tarrazona, Sabater-Grande and Georgantzis, 2020; Attanasi et al., 2018). Furthermore, an additional concern is that even apparently consistent responses may have been inconsistent had more sets of stakes been explored (Attanasi et al., 2018). This means that there is a risk of being unable to appropriately characterise the risk aversion levels of certain research participants. Moreover, this single parameter measure which only considers a specific set of stakes (constant from one lottery pair to the next) gives a narrow view of the complex construct that is individuals' risk aversion. This results in a measure that has been shown to be very inconsistent over time (Dohmen et al., 2011; Lönnqvist et al., 2015).

On the other hand Dohmen et al.'s (2011) survey instrument, involves capturing self-reported willingness to take risks in general and in several relevant contexts, namely, driving, financial matters, sport and leisure activities, career decisions, health behaviours, and trusting strangers. Lönnqvist et al. (2015) find the instrument to relate, better than MPL, to risk-taking behaviour in an experiment, and to remain consistent on re-test, i.e. over time. However, due to

its origin in the economics literature, this is a scale that has yet to be validated by regular psychometric standards. It is not clear whether risk attitudes in all these contexts would converge sufficiently to meet standards of convergent validity and unidimensionality (Zhang, Dawson and Kline, 2021). If these are not met, it would be necessary to construct items for each of the relevant first order dimensions of the second order construct. While these are admittedly important questions, they lie beyond the scope of the present research. These important gaps in the literature make it an unsuitable instrument for this research design.

	Lottery 1		**Lottery 2**
	10% chance of $100 and 90% chance of $80		10% chance of $190 and 90% chance of $5
	20% chance of $100 and 80% chance of $80		20% chance of $190 and 80% chance of $5
	30% chance of $100 and 70% chance of $80		30% chance of $190 and 70% chance of $5
	40% chance of $100 and 60% chance of $80		40% chance of $190 and 60% chance of $5
	50% chance of $100 and 50% chance of $80		50% chance of $190 and 50% chance of $5
	60% chance of $100 and 40% chance of $80		60% chance of $190 and 40% chance of $5
	70% chance of $100 and 30% chance of $80		70% chance of $190 and 30% chance of $5
	80% chance of $100 and 20% chance of $80		80% chance of $190 and 20% chance of $5
	90% chance of $100 and 10% chance of $80		90% chance of $190 and 10% chance of $5
	100% chance of $100 and 0% chance of $80		100% chance of $190 and 0% chance of $5

Table 9. Holt and Laurie (2002) task. A column change taking place before the 50-50 prospect indicates risk aversion, a change a t the 50-50 mark would indicate risk neutrality and after this mark, risk-loving.

The SGG lottery panel task (Sabater-Grande and Georgantzis, 2002), uses four lottery panels containing varying stakes which are all anchored at one end, 1 euro with certainty. This is shown in Table 10. Each of the panels provides a point of comparison between individuals, i.e. a variable, with lower probabilities indicating lower degrees of risk aversion. Additionally, each of the panels adds information on the sensitivity and form of reaction of risk aversion to changing stakes. Moreover, there are no 'irrational' responses, such that apparently inconsistent responses across the panels can be mathematically characterised, and they can be used to classify respondents according to different motivations (e.g. aspiration levels and non-monotonic behaviour) related to how risk aversion reacts to the availability of different sets of stakes (Attanasi et al., 2018). For example, the MPL task and Dohmen et al.'s (2011) self-reported instrument have been shown to not relate empirically to one another (Holt and Laury, 2002; Lönnqvist et al., 2015; Attanasi et al., 2018). However, restricting the comparison to subjects identified as consistent across the SGG task panels, i.e. those who consistently pick lotteries at, or to the right, of the lotteries chosen in preceding panels, bridges this gap (Attanasi et al., 2018).

Probability of winning		1	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1
(Panel)	**(1)**	1	1.12	1.27	1.47	1.73	2.10	2.65	3.56	5.40	10.90
Euros	**(2)**	1	1.20	1.50	1.90	2.30	3	4	5.70	9.00	19
	(3)	1	1.66	2.50	3.57	5	7	10	15	25	55
	(4)	1	2.20	3.80	5.70	8.30	12	17.50	26.70	45	100

Table 10. SGG risk elicitation task (Sabater-Grande and Georgantzis, 2002). One of the ten lotteries is chosen from each of the four panels. The lotteries have the probability shown in the table of winning the associated amount in euros, and the converse of resulting in no payment. The probability associated with an individual's choice is a measure of their risk aversion, i.e. individuals who pick riskier prospects are less averse to risk.

In sum, it was deemed that the SGG task offers the best features for the purposes of this research, marrying the best features of the MPL task with additional qualities which help to more precisely characterise risk aversion. While Dohmen et al.'s (2011) self-report reliant instrument is promising, the task of its appropriate psychometric validation is much more daunting than the scope of this research requires at this stage. Moreover, the SGG task has the benefit of not relying on respondents' interpretation of the stakes and their willingness to take risks. That is since money offers an objective framing of stakes (i.e. 100 euros are the same to everyone - even when reactions to the same amount vary between individuals, the amount to which they react is the same). As proposed by the authors (Barreda-Tarrazona, Sabater-Grande and Georgantzis, 2020) an index is constructed by taking the average of the probabilities of the four lottery panels, hence incorporating information about risk aversion at varying stakes. It is worth noting that the SGG was hereby administered without monetary incentives, which has been shown to bear little effect on the reliability of responses in the context of risk aversion (Hackethal et al., 2023).

4.4.4 Behavioural Intentions

Internal vs. external (to the experiment)

In addition to observing behaviour through the experiment, measurement items (questionnaire type questions) measured in 7-point Likert scales, were also put in place to measure respondents' behavioural intentions. In line with the conceptualisation developed in Chapter 3 relating to abstraction bias and its role in the intentions-behaviour gap (IBG), intentions framed with different degree of abstraction are measured.

To do this, intentions that refer to the exact consumption setting in which participants would later engage were introduced. These are as concrete as possible since not only are they about a real situation, but the real situation would take place shortly after, putting individuals' self-reports to the test. This single-construct questionnaire was administered before being given the instructions of the experiment, that is without knowing about the game they would be participating in. A general description mirroring the experiment they were about to participate in was provided, then they were asked questions about what their intentions would be regarding their consumption behaviour in the described hypothetical setting, namely relating to self-profit vs. collective-profit maximising strategies.

These can be classified as intentions that are *internal* to the experimental setting. In other words, they are intentions about a specific consumption context in which behaviour can then be observed. This is not usually the case in survey studies about sustainable consumer behaviour (SCB), where intentions and behaviour can rarely be matched one-to-one in terms of the setting and context. For example, intentions are often measured in more general terms, such as "intentions to be more responsible" or "intentions to recycle more", however the behaviour of interest tends to either be more specific, like "turning off the lights when they're not necessary" or measured by many measurement items pertaining to different behaviours of interest, that can be considered pro-environmental. This was necessarily treated as an exploratory set of questionnaire items since the context is too specific to employ an already validated instrument. Following exploratory factor analysis (EFA), only items that were framed negatively, i.e. intentions to behave so as to maximise self-profit (INT), showed enough signs of convergent validity to be transferred to subsequent confirmatory testing (see Appendix D). This resulted in a factor of intentions that is negatively operationalised relative to SCB. The specific items used are shown in Table 11 below. Due to the empirical nature of this sign reversal, rather than considering it a case of reverse-coding, it is taken to represent a better representation of individuals' understanding. In further support of this, subsequent regression analysis of these items suggested that negatively framed items were significantly better predictors of behaviour than positively framed ones (see Georgantzis Garcia et al., 2022).

On the other hand, in order to explore the effects of abstraction bias on behaviour, intentions framed more abstractly are also necessary to measure. This was done by introducing questions about general intentions to consume less, and to behave more sustainably, which were not related to the experimental context. The associated questionnaire was completed at the end

of the experiment, and included two[7] sets of questions about intentions to behave more sustainably, adapted from previous research (Li et al., 2018; Si et al., 2020) to reflect these at two different levels of abstraction inspired by the present conceptualisation of SCB (Chapter 3). In particular, items were developed pertaining to the more general framing of intentions to consume more sustainably (BISUST), and the more concrete one of intentions to consume less (BIRED). These are shown in Table 11 and can be classified as *external* to the experiment. Hence, the typical setting/context misalignment between measured intentions and actual behaviour are expected to differing degrees, when it comes to these questions and the experiment. Since behaviour is observed rather than measured through self-reports, it is possible to explore the consequences of these misalignments on the potential of intentions to explain actual behaviour.

BISUST – Intentions (external) to consume more sustainably	**A1**
1. I would like to consume products and services in a sustainable way in the future.	
2. I will try to consume products and services in a sustainable way in the future.	
3. I will insist on consuming products and services in a sustainable way in the future.	
BIRED – Intentions (external) to consume less	**A2**
1. I would like to consume less in the future.	
2. I will try to consume less in the future.	
3. I am willing to consume less in the future.	
INT – Intentions (internal) to behave selfishly within the experiment	**A3**
1. I would intend to behave so as to profit as much as possible, without consideration for other members of the group.	
2. I would extract as much as possible from the resources.	
3. I would extract as much as possible from the resources, as long as the probability of the world ending is low enough.	
4. The most important thing for me would be to benefit as much as possible from the resource.	

Table 11. Questionnaire items for behavioural intentions constructs framed at different levels of abstraction. A1 – Highly abstract; A2 – Abstract; A3 – Concrete. BISUST - Intentions to consume more sustainably); BIRED - Intentions to consume less. Adapted from Li et al. (2018) and Si et al. (2020). INT – intentions to behave selfishly within the experiment. Questions followed a detailed description of the experimental world and were answered by participants prior to engagement in the experiment.

[7] Items pertaining to a third notion, intentions to produce less waste, were also included but did not meet inclusion criteria beyond EFA stage. These items overlapped significantly with BISUST items and showed signs of poor convergent validity (see Appendix EFA).

Classifying intentions in terms of their framing's abstraction

Items that were internal to the experiment, relating to the INT measure, are considered the most concrete of the three measured constructs of behavioural intentions. That is because, compared to external intentions, the behavioural setting is exactly matched through a detailed description of the consumption setting. Therefore, external intentions, BISUST and BIRED, are both more abstract than INT regarding the behavioural setting they refer to. This is shown in Table 11. With regards to BISUST and BIRED, the former is completely goal-oriented and makes no mention of the mechanisms or processes it entails. Behaving more sustainably may be understood different between different people. In comparison, BIRED is framed less as a goal and more as a specific action or set of actions, as it clearly refers to a reduction in consumption quantity – while the setting is ambiguous, the action is concrete. Moreover, BISUST allows individuals to interpret or create expectations about the consequences of their behaviour (i.e. increased sustainability or not), making the action more susceptible to abstraction bias. This makes BIRED more concrete since the outcome of consuming less is clearly and explicitly the action itself, so that it does not have to be imagined. In the case of BISUST, both the context and the action are ambiguous. It follows that BISUST is the most abstract framing of intentions.

4.4.5 Sustainable consumer behaviour

As introduced in the conceptual framework of this Thesis (Chapter 3), sustainable consumer behaviour (SCB) is regarded in this research as behaviour **that contributes positively to the sustainability of the resource-generating system in which it occurs**. Therefore, making behaviour more sustainable requires quantitative reductions in consumption to be a priority. Moreover, it is not enough to adopt *some* high entropy solutions to mitigate individual consumption's impacts, instead shifts toward more SCB should be sustained and happen at the cultural and normative levels (Vergragt, Akenji and Dewick, 2014; Reisch and Thøgersen, 2015). Additionally, consumers are highly conditioned and limited by their institutional setting (Coffin and Egan–Wyer, 2022), therefore a sustainable consumer in one national context may be considered very unsustainable in another, because it is taken relative to the local norm. When translating this into the behavioural setting of the experiment, some important features that operationalisation should capture are identified. First, consuming less is to be considered indicative of higher adoption of SCB. Second, a single action is not enough to determine how sustainable the individual is behaviourally, it is more realistic to consider several observations

taken together (Maleetipwan-Mattsson, 2013). Third, not all levels of consumption are always equally indicative of SCB in different institutional settings. Since all experimental groups share the starting parametrisation, the only non-random differences occur through group members' consumption behaviour. However, this may induce significant variance in SCB due to the different contexts created from one round to the next. In other words, a nested data structure. This can be addressed through multi-level modelling techniques, taking individual-level consumption as the outcome variable. This is done in the linear mixed model proposed in Chapter 6. Alternatively, behaviour can be considered relative to others' in the group in order to account for differences in situation and context implicitly.

The structural equation model (SEM) (presented in Chapter 5) aims to empirically assess the relevant theoretical hypotheses developed in Chapter 3, shown in Table 7. These are analysed in a context where institutional setting is made implicit in the behavioural variable. Since context is shared among participants of the same group, but different between groups, behaviour is taken relative to that of other members of their matching group. Therefore, it is not just the size of a participant's extraction which is used to compare them to the rest of the sample, but its relative size compared to other group members. This captures the fact that the most sustainable people in one setting may not be the most sustainable people in another setting or overall, precisely due to differences in setting. Reality operates in the same way since the ability to act sustainably is highly dependent on the availability of the right setting and infrastructure. Therefore, someone who is considered the most sustainable consumer in one national or cultural setting could rank much lower when compared to, for example, a population living in a better informed setting with better infrastructure, and/or better aligned norms. Such an assumption is also implicit in SCB operationalisation in typical survey-based studies that employ self-reported measures and quantitative analyses (Li et al., 2018; Si et al., 2020). In these, operationalisation also occurs relative to others' responses, i.e. people are considered to score higher or lower around a sample mean – which is why scales are constructed based on a relevant population of respondents (Netemeyer, Bearden and Sharma, 2003). Therefore, a sample that contains comparable observations is necessary, unless national, cultural or any other notion of setting with a significant influence on SCB can be explicitly controlled for.

In the SEM analysis which is presented in Chapter 5, SCB is operationalised as respondents' average consumption behaviour over time in the experiment, relative to consumption behaviour

of other players within the same group. In other words, the *average relative consumption* of respondent i is defined as follows:

$$\text{avgrelconsum}_i = mean\left(\frac{\text{consumption}}{\text{mean consumption of others}}\right)_i \quad \text{Eq. (1)}$$

The resulting variable, *avgrelconsum*, condenses information about respondents' global behaviour (i.e. by considering several instances over time) and within their own institutional setting. This removes the hierarchical structure originally present in the data relative to the consumption variable due to behaviour taking place within groups and subjects, at each period. Therefore it strongly facilitates the estimation of SEM (see Chapter 5) while offering an alternative perspective, and not a poorer one, compared to the multilevel modelling techniques that can be used to account for the hierarchical structure of the data (like the analysis in Chapter 6 does). A more in depth discussion of the complementarity of SEM and regression analyses was provided in the research design selection section of this chapter (Section 4.3.3).

In sum, the present research operationalises behaviour such that is (1) directly observed, (2) increasing with growing consumption levels relative to others' in the same group, and (3) takes into account behaviour at different points in time and relative to its given institutional setting. These are critical features of this research design that increase realism, validity and reliability (see Section 4.3.5), as well as, comparability with extant research employing TPB-based analytical frameworks. Moreover, all this is achieved without requiring the use of multi-level SEM analysis, which would significantly increase the load on, and reduce the availability of, appropriate statistical software, more saliently so for ordinal, and/or non-normal data.

Notwithstanding, multilevel modelling is also used in Chapter 6 to explore the dynamics of the experiment, offering a closer look at the role of institutional setting and its interactions with psychological and demographic factors. Through these two operationalisations of SCB, analyses based on both psychometric and econometric approaches, as well as their combination, are facilitated. This offers a greater confidence in the results and a combination of perspectives which allow for a more nuanced interpretation and enhance the identification of new mechanisms (Section 4.3.3).

4.4.6 Institutional setting: Operationalisation and hypotheses

Formally, institutional setting has been defined here as **the physical and cognitive resources (e.g. infrastructure, information, rules, norms) which enable the influence of regulative and**

normative institutional forces on individual behaviour. The following propositions, developed in Chapter 3 (p. 74) serve as the starting point for the present discussion on the operationalisation of institutional setting, and subsequent development of specific hypotheses, that are adopted in this research:

Proposition 1: *Institutional settings vary in their degree of alignment with an ideal case.*

Proposition 2: *Different components of institutional setting may contribute positively or negatively to its alignment with an ideal case.*

Proposition 3: *The effect of a given component of institutional setting on the adoption of sustainable behaviour, is proportional to its contribution to the setting's alignment with an ideal case.*

As illustrated by the above propositions and the discussion of Section 3.4.5, rather than a quantity, institutional setting can only be assessed in terms of its alignment with an ideal case, defined as the optimal institutional setting for a given behaviour to arise. We can't have *more* institutional setting, but rather one that is better at facilitating or enabling some behaviour. Therefore, institutional setting is made up of separate elements which influence behaviour. This, as explained in Section 3.4, makes institutional setting a multi-faceted concept that cannot be directly operationalised, but requires instead that each of its components are considered separately. This is further evidenced by Proposition 2 which implies that elements of institutional setting have their own independent relationships to behaviour. Since the experimental context, and hence, the specific elements of institutional setting that are to be measured in this research had not been introduced, hypotheses about institutional setting were not developed in Chapter 3. Instead, Section 3.4.5 concerned the definition of the concept and the development of theoretical statements, i.e. propositions 1-3, to create a bridge between the concept of institutional setting and its building elements. As such, in this section, the specific institutional setting elements that were designed into the experiment and measured are introduced, and specific hypotheses are developed about their influences on behaviour, and on the effect of other variables (interactions).

In the Armageddon game, institutional setting manifests itself in the form of information quality, the dynamics of resource availability and others' behaviour. These are operationalised as follows: Information quality corresponds to the treatment variable. Half the matching groups in the experiment engaged with a setting where the exact probability of survival was not known, while the other half did have that information. This is expected to lead to increased adoption of

sustainable consumer behaviour (SCB) by enhancing individuals' ability to understand the real collective consequences of their actions. Therefore, the following hypothesis is formulated:

Hypothesis 8: *Better information quality positively influences adoption of sustainable behaviour.*

The dynamics of the common pool resource are operationalised as a percentage of the resource's original size. At period 1 all groups start with 100%. The resource size variable refers specifically to the size of the resource at the time of decision making, i.e. after regeneration from the previous round. This variable varies between groups and over time. It is perhaps natural to consider that as the resource is depleted, individual consumption is disincentivised. This makes reference to the effect of resource scarcity. However, the lack of scarcity cannot be dismissed. Abundance can play an equally significant and opposite role. Rather than simply hypothesising a linear negative effect of the resource size on consumption, the effect of the resource size on consumption can depend on the resource size itself, and whether this is considered abundant or scarce by individuals. This leads to the following two hypotheses:

Hypothesis 9: *The effect of resource size on adoption of sustainable behaviour depends on whether it is considered abundant or scarce.*

H9a: *Resource abundance negatively influences adoption of sustainable behaviour.*

H9b: *Resource scarcity positively influences adoption of sustainable behaviour.*

The behaviour of others in the group is an important element of institutional setting. At the end of every experimental round, individuals are given this information. Therefore, individuals can only react to others' consumption in the previous round. As such, others' consumption is operationalised as the sum of all tokens others consumed at time $t - 1$. Naturally, based on the concept of herding behaviour (Baddeley, 2010), whereby individuals are observed to mimic others' behaviour, it is reasonable to expect some replication of in-group behaviour. In other words, this leads to the conclusion that as the group consumes more, so do individuals. However, locally, individuals may also react to increases in others' consumption by reducing theirs in an attempt to "save the world". This is in line with the concept of free riding which is typically observed in public good and common pool resource games (Jordahl and Liang, 2010; Furusawa and Konishi, 2011; Ozono et al., 2016; Shreedhar, Tavoni and Marchiori, 2020). Namely, individuals who enjoy the collective profit without contributing to it is consider to free ride on others' contributions. It is natural to expect that the scale will tilt more in the direction of a negative effect for individuals who are more environmentally conscious and psychologically closer to the

consequences of overextraction. It follows that a similar expectation arises in the case of gender, where females are expected to be more conscious and willing to change relative to males.

Hypothesis 10: *Belonging to a setting where more is consumed negatively predicts individuals' adoption of sustainable behaviour.*

Hypothesis 11: *Other's consumption incentivises reductions in individuals' consumption by creating the necessity for more sustainable behaviour.*

Hypothesis 12: *Other's consumption incentivises increased SCB of individuals' more for individuals with greater dispositions toward sustainable consumption, relative to lower scoring ones.*

Hypothesis 13: *Other's consumption incentivises sustainable behaviour of individuals more for individuals that are less psychologically distant from climate change, relative more distant ones.*

Moreover, as proposed throughout this Thesis, institutional setting plays a crucial role, and failure to account for it is at least partly responsible for the intentions-behaviour gap (IBG). Omitting institutional or consumption setting is expected to lead to overestimation of the effects of psychological and demographic factors on actual behavioural outcomes. The following hypotheses are developed as a result:

Hypothesis 14: *The effect of intentions is limited by institutional setting.*

Hypothesis 15: *The effects of psychological and demographic factors on behaviour are fragile relative to changes in institutional setting.*

Hypothesis 16: *Failure to account for institutional setting leads to overestimation of the potential of psychological and demographic variables to explain more sustainable behaviour.*

The following section provides a discussion on research context, experimental protocol and participants in the data collection process.

4.5 Describing data collection site, protocol and participants

This section begins by discussing the definition of the research context underlying this research (Section 4.5.1). An in depth account of experimental protocol that was applied follows, in Section 4.5.2. Then, an overview of the experimental instructions given to participants is provided in Section 4.5.3. Finally, Section 4.5.4 concludes by providing an descriptive overview of the sample.

4.5.1 Defining the research context

The unit of analysis is defined in this Thesis as the individual consumer in the context of a circular economy (CE) and sustainable consumer behaviour (SCB). Data were collected in Spain, whose suitability as a data collection site is argued for below, by considering the broader context of this Thesis research.

It has been argued that developed (for the lack of a better name) nations, are responsible for most of the environmental impacts of humanity on Earth (Wijaya, 2014). The consumption context of interest to this research is characterised by a culture of consumerism, most characteristic of developed nations. That is partly because individuals in developing countries experience a significantly different consumption context characterised by increased poverty and technological stagnation. Therefore data collection that is suitable for making observations in this Thesis should take place in a cultural context of these characteristics.

Moreover, the rise of consumerism, as argued in the literature review (Chapter 2), originates primarily from the neo-liberal free market economies that dominate westernised societies. The origin of consumerism as it is currently know can be traced back to the early-mid 1900s, and was geographically focused in Western Europe and United States (Bostan, 2010; Roach, Goodwin and Nelson, 2019). Notably, it is still European and The United States (US) that exemplify the notion of consumerism best (Chessel, 2002). However, not only is the average consumer in the US much more impactful than in Europe, but policy against consumerism is much more salient in the latter (Bostan, 2010; Roach, Goodwin and Nelson, 2019). This suggests the European context is not only a good representative of the type of consumer that is the focus of this Thesis, but also it shows more signs of potential for behaviour and policy changes.

Spain is a European country that is a part of the Organisation for Economic Co-operation and Development (OECD). The latter is an international effort to generate knowledge and understanding of economic development and global issues such as sustainability. Importantly, it is comprised primarily of developed nations which align with the research context described hereby. The list of countries spans North to South American, European and Asia-Pacific regions but is European-dominated, which makes it a good point of comparison. A recent report has shown that Spain exhibits mostly close-to-average values on many societal, political and economic measures and indices (OECD, 2023). Moreover, Spain is a common national context for studying SCB and the intentions-behaviour gap (IBG) empirically (Papaoikonomou, Ryan and Ginieis, 2011; Barbeta-Viñas, 2023).This suggests that, since they are in Western Europe and are

somewhat representative of the OECD averages, and are a commonly sampled population in the study of SCB, Spanish consumers are well aligned culturally and geographically with the research context of this Thesis.

4.5.2 Experimental protocol

Data were collected in three days, comprising a total of eight sessions, during November of 2021 at the Laboratori d'Economia Experimental (LEE) (Universitat Jaume I, Castellón, Spain). In each of the first two days, three sessions with 40 participants each were carried out. The final day, two sessions were run, one with 40 participants first; followed by a final one with 16 participants. The sessions were spaced out as little as possible to increase internal validity of the experiment by increasing homogeneity in application and setting. In total, the experiment hosted 296 participants (74 groups of 4 participants each) from LEE's subject pool. The experiment was programmed and implemented using z-Tree (Zurich Toolbox for Readymade Economic Experiments) software (Fischbacher, 2007). Given that during November 2021 Covid-19 counter-measures were in force, to minimise associated risks to participants, researchers and laboratory staff, the laboratory had a protocol in place that was always adhered to closely by all parties involved. Participants were made aware of the protocol in the recruitment email, prior to making the decision to participate. This research has obtained ethics clearance from the Research Ethics Committee of Sheffield University Management School (SUMS). All participants were 18 years old or older, and no deception was used in the experimental setup. All participants in the experiment completed written consent forms before the start of each experimental session. The data was anonymised before the analyses.

On arrival at the laboratory, participants were instructed to sit such that their order of arrival had nothing to do with the laboratory's sitting layout during the experiment. This was done as an extra step, on top of the measures already present in the laboratory, to minimise the risk of groups of participants interacting during the experiment. Their spots in the lab were random up to gender-per-treatment. In other words, the only restriction was placed on ensuring comparable gender representation in both treatments. Participants were then asked to complete the consent form, of which they had been informed in the recruitment email.

Before the start of the experiment, and after reading a description of a hypothetical setting mirroring that of the AG in which they would later engage, all participants completed a short questionnaire about their intentions to behave if faced with said setting. These reflect the internal

intentions (INT) construct, see Table 11. Once all participants had finished answering the pre-experiment questionnaire, the lead researcher moved on to reading the parts of the instructions that were common to both treatments. The instructions used in the experiment, in Spanish, and their English translation are offered in Appendix E. In these, participants were informed of the group matching procedure and payments, described in more detail in the following section. The rest of the instructions (see Appendix E) were read individually by participants.

Participants were given a full copy of the instructions containing a glossary at the end with succinct definitions and information for each of the concepts introduced. These concepts are: Common fund, private fund, extraction/consumption, Armageddon event (a catastrophic end of the game), P parameter (representing the probability of survival of the world from one round to the next), final round, and payment round. Everyone was allowed to refer to the full instructions, glossary, and/or raise their hands to ask for clarifications at any given time beyond this point and until the end of the experiment. Naturally they had to remain silent and focused within their cubicle while doing so. This helps minimise the negative effects that lack of comprehension of the game may otherwise have on experimental outcomes, which is important to address given the potentially perceived complexity of the game.

As a further measure to minimise this risk, participants completed an instruction comprehension test, designed to address typical misconceptions or misunderstandings about the game. The test included questions (8 in total) about the definition and consequences of an Armageddon event, the P parameter (which becomes the probability of survival beyond a randomly determined round), the common fund, the private fund, Payment 1, Payment 2, and the determination of the total profit of participants. The test was not meant as a filtering strategy, i.e. no participants were cut off based on their performance, instead its purpose was to give participants a further platform to make considerations about the experiment, and realise potential misunderstandings they may have had, before engaging with it. In addition, their time of completion was recorded as a proxy for individuals' comprehension of the game, enabling for the control for this issue, which showed no sign of having a negative influence on experimental outcomes, as discussed in Section 4.3.5.

Having completed the instruction comprehension test, participants moved on to engage in the AG, and once they reached the end of the game, they were asked to complete a short questionnaire. This contained demographic questions, the ones relevant to this research being gender, age, and level of education; and questions capturing psychological features of

participants. Namely these included behavioural intentions external to the experiment (BISUST and BIRED, see Table 11), dispositions for sustainable consumption and psychological distance. The SGG task measuring risk aversion was also conducted as part of the survey.

4.5.3 Participants

Participants were recruited through LEE's established data panel and recruitment procedures. The experiments were carried out in the same laboratory, located in Castellón, Spain. After the experimental sessions had concluded, the laboratory audited all the documents that were produced during the experiment (receipts, consent forms etc.), and found one inconsistency. One participant had provided personal information to the laboratory, that was inconsistent across documents. Based on this breach of the recruitment protocol, the laboratory flagged to the researchers that there was a potentially problematic participant. As it turned out, the same participant (with subject ID = 225) had provided imprecise information also about their age and level of education. The participant was removed from all subsequent analyses, on the grounds of concern for the credibility of their responses, in order to avoid introducing undesirable fixed subject effects. No other issues were encountered in recruitment.

While the data panel is primarily composed of students, it contains students at different stages of education and non-students, as shown in Figure 2. No quotas were imposed on sampling regarding age nor education, but equal representation from both genders was sought across treatments. Table 12 presents descriptive statistics for Age and Gender (n=295; mean age = 22.2; female = 52.2%). Since no quotas were placed on the Age variable on recruitment, some extreme values were collected. However, outliers in terms of age were shown to not result in outlier behaviour and response, relative to the rest of the sample (see Appendix C).

In terms of the education profiles in the obtained sample, at the time of data collection, 52.9% had attained a bachelor's degree or equivalent, 34.9% had completed upper secondary education, 5.41% had completed short-cycle tertiary education, another 5.41% had attained a Master's degree or equivalent, while the remaining respondents had either completed post-secondary non-tertiary education (1.0%) or was at the Doctoral level (0.3%; a single respondent). In other words, the sample is not exactly the typically criticised undergraduate student samples which are primarily undergraduate (Sears, 1986; Falk, Meier and Zehnder, 2013). Even such criticisms have been readily addressed and have failed to prove their claims (Druckman and Kam, 2011). It has been argued that student samples in fact provide the perfect starting point for

studying social preferences as they can minimise confounding effects of socio-demographic variables (Gächter, 2010). Therefore, the high proportion of students can in fact be beneficial, particularly when applying a new experimental paradigm.

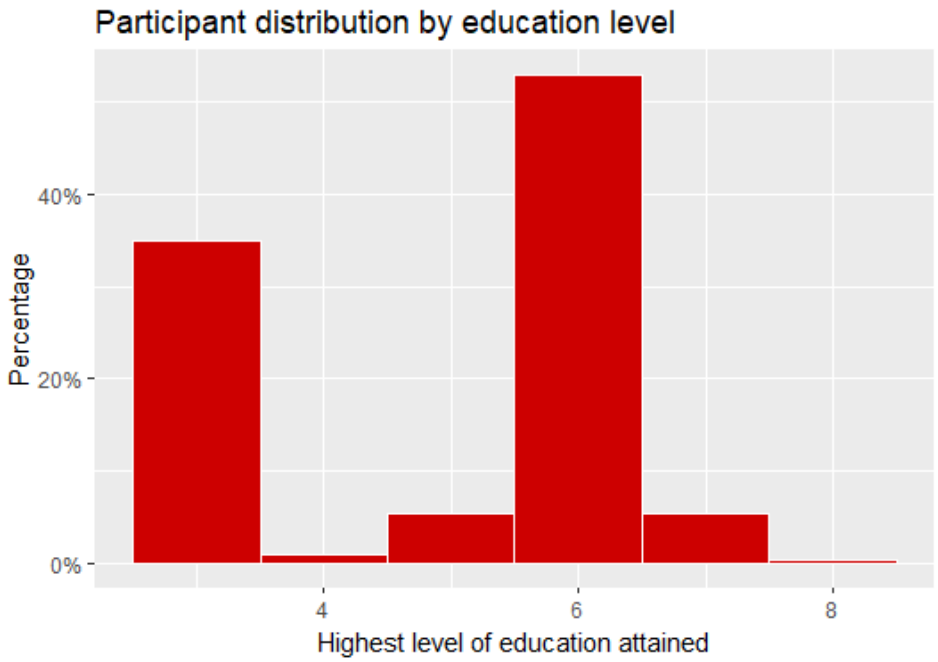


Figure 2. Participant distribution by education level. Education categories are: 3-Upper secondary education; 4-Post-secondary non-tertiary education; 5-Short-cycle tertiary education; 6-Bachelor's degree or equivalent; 7-Master's degree or equivalent; 8-Doctoral level. All participants had attained a minimum of upper secondary education at the time of data collection.

Variable	N	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis
Age	295	22.15	4.71	18	69	4.75	36.81
Gender (Fem=1)	295	0.52	0.50	0	1	-0.09	-2.00

Table 12. Descriptive statistics for age and sex. Sex is coded as 1-female and 0-male.

Participants from this subject pool usually have some experience with participating in experiments in economics, which helps increase comprehension of both the game, and the consequences, hence boosting incentive compatibility. Comparable representation from both genders was sought at the treatment level, to allow for proper control and exploration of gender effects (T1: female = 52.7%; T0: female = 51.7%). On recruitment, all participants were given a copy of the information sheet (provided in Appendix F) to read in their own time and were informed that the completion of a consent form will be required to participate.

Data handling and outliers

Among the main benefits of running a controlled laboratory experiment, compared to online survey questionnaires, is the quality of the data (Uittenhove, Jeanneret and Vergauwe, 2023). This is even more salient when samples are crowdsourced online (Brühlmann et al., 2020; Uittenhove, Jeanneret and Vergauwe, 2023). The use of a subject pool carefully constructed over the years by an experimental economics laboratory operating within a university, further benefits data quality. Having removed the only problematic participant which was flagged by the laboratory due to breaching the recruitment procedure, no other problems were encountered in the sense of missing data or outliers. In particular, the experimental setting is such that missing data entries were not possible as moving onto the next phase was subject to responding in the present one. Participants were informed that they could leave the experiment at any point they chose, which did not happen in any of the experimental sessions. However, in order to complete participation it was necessary to engage in every experimental decision and respond to every questionnaire item, in order to reach the end of the session. An in-depth analysis of potential outlier problems was conducted which is described in short below, and in more detail in Appendix C.

The detection and handling of outliers, i.e. extreme values, in the data is critical prior to running any kind of statistical analysis, and particularly parametric statistics (Roth and Switzer, 2004; Hair Jr et al., 2010). Outliers can affect data normality, which is a basic assumption of parametric statistical methods, and lead to both over and/or underestimation of statistical effects (Zimmerman and Zumbo, 1990). Influential cases are outliers that have one or both of the aforementioned effects on the analysis at hand (Roth and Switzer, 2004).

Univariate and multivariate outliers were first identified, through z-scores and Mahalanobis distance, respectively. Subsequently data inspections and statistical analyses were conducted, including probit models on the outcome of being an outlier, to identify potential causes for their existence (see Appendix C). These tests provide a basis for determining whether they should be excluded from subsequent analysis. The potential causes of outliers that were considered were: (1) errors in data entry, (2) poor question-wording, (3) incorrect coding of missing data, (4) sampling error and (5) legitimate extreme values from the intended population (Tabachnick, Fidell and Ullman, 2013). The analysis, which can be found in Appendix C, pointed at no issue of errors in sampling, data entry, question wording, nor incorrect missing data coding. Therefore, no grounds were found for the exclusion of any observations on the basis of being outliers relative to the sample.

4.5.4 Experimental instructions

The instructions provided to participants contained information common to both treatments and parts specific to each. In the former, which was read out loud and explained by the lead researcher, participants were informed that they would be randomly grouped with three other participants, forming groups of four. Also, during the experiment, earnings and payments would be expressed in experimental tokens following an exchange rate of 10 tokens = 1€. Then, the next part of the instructions, detailing the payments, was read aloud to all participants. Finally, some general rules forbidding the use of a calculator and any form of communication between participants were read. Participants were then allowed plenty of time (10 minutes maximum) to read the part of the instructions which differs slightly between treatments. Figure 3 provides a schematic representation of the game as it was explained to participants.

Payments

Participants were informed of the existence of two payments: Payment 1, defined as the extraction in tokens corresponding to one of the rounds played determined at random, and Payment 2, defined as individuals' number of tokens accumulated over all rounds; provided a randomly determined "**final round**" is reached.

The rules of the game

Participants were informed that there would be rounds, across which initial conditions may change but the decision will remain of the same type. The AG was then introduced by describing each round as two separate phases: the beginning and the end of the round. Participants were informed that in the beginning phase of the round, they will be shown the number of tokens available in a common fund; shared among all members of their group and which will start off containing 1300 tokens; from which they will have to choose an integer number of tokens, between (and including) 1 and 18, to extract. Also, that all other members of the group will be making the same type of decision. Next, it was explained to participants that once all members of their group have decided, the tokens they extract individually will be added to their private fund, and the common fund will be left with the tokens remaining. To finalise the beginning phase of the round, they were informed that a parameter P, representing a percentage, will be calculated

based on the size of the common fund after extraction. Namely, the larger the size of the common fund, the lower the value of P.

At the end-of-the-round phase participants were informed that they will be shown a "history" table containing the values of the following variables: common fund (resource) size, private fund size, collective extraction (i.e. the sum of all individual extractions in the same group), and their own individual extraction. Individuals in the base treatment were informed that the exact value of P would be unknown and this information was not shown at the end of the round. This is referred to hereby as the ambiguity[8] treatment since it relates to an unknown probability. For the other treatment, the risk treatment, this information was explicitly provided at the end of each round such that probabilities are known, and they were informed of this in the instructions.

Next, participants were informed that beyond a randomly determined round (named Z), unknown to both researchers and participants, P becomes the probability of an Armageddon (or end-of-the world) event taking place before the start of the next round, for their group. Before round Z, the probability of an Armageddon event taking place is 0. Additionally, such an event taking place results in an abrupt ending of the game and emptying of all private funds in the affected group, making all Payment 2's for said group equal to 0€. Provided the game moves on to the next round, the common fund will regenerate 20 tokens (max.), without ever surpassing the common fund's original size of 1300 tokens. Finally, participants were informed that once the common fund has regenerated, they will move onto the next round which will be the same as the previous one except (potentially) for the size of the resource, which may decrease or increase between rounds. Also, this process will be repeated from one round to the next until one of two things happens: An Armageddon event ends the game abruptly and prematurely, or the final round (which is determined at random for each group) is reached. A flow chart of the AG experiment as explained to participants is shown in Figure 3.

[8] The convention adopted here is that both ambiguity and risk are concepts that fall under the uncertainty umbrella. Therefore, uncertainty refers to probability subjected scenarios without specifying whether it is a known (risk) or unknown (ambiguity) prospect (see Palm-Forster and Suter, 2022).

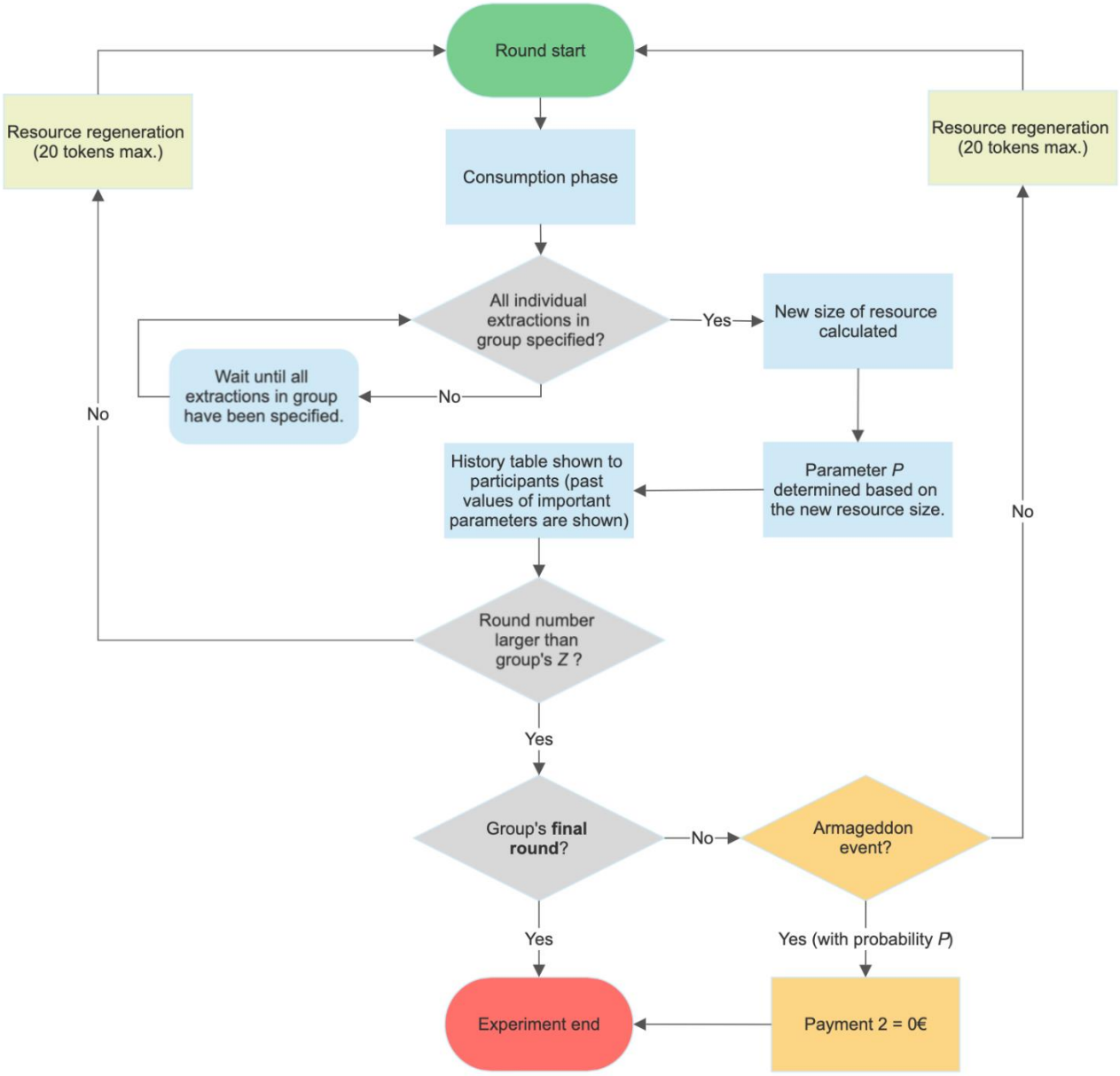


Figure 3. Flow chart of the Armageddon game experiment from the start of the first round to end of experiment.

CHAPTER 5: ANALYSIS AND RESULTS I

5.1 Introduction

The previous chapter dealt with methodological aspects of this Thesis. This chapter involves fitting a structural equation model (SEM) with the goal of testing hypotheses developed in Chapter 3. The chapter begins by considering content validity, including unidimensionality (Section 5.2.2), construct reliability and convergent (Section 5.2.3), and discriminant validity (Section 5.2.4), by means of confirmatory factor analysis (CFA) of all the factors measured by means of the items of the instruments established in Chapter 4 (Table 8, p. 101), the items of which are shown in Section 5.2.2 (Table 13, p. 133). Having established content validity of utilised measures, the chapter then reports the structural model (Section 5.3) and presents the results in relation to theoretical hypotheses (Section 5.4).

5.2 Confirmatory factor analysis: The measurement model

A confirmatory factor analysis (CFA) model takes a hypothesised factor structure as an input, and aims to confirm (or discard) empirically the theorised measurement model. In order to do so, a specific kind of model (specified below) must be fit, on which several aspects of content validity can be assessed empirically (Hair Jr et al., 2010; Goretzko, Siemund and Sterner, 2023).

The CFA model is summarised in Section 5.2.2 (Table 13, p. 133), together with reliability coefficients, average variance extracted (AVE) estimates and model fit indices, namely the comparative fit index (CFI), Tucker-Lewis index (TLI), root mean squared error of approximation (RMSEA) and standardized root mean square residual (SRMR). The relevance of these is discussed below, in the context of considering all the building blocks of content validity.

5.2.1 Providing an overview of Type I and II errors using regression example

Beneficial to this discussion is a proper understanding of the notions of Type I and Type II errors. These can be illustrated by considering a research hypothesis about an independent variable influencing a dependent variable linearly. A given statistical test will either accept or reject this. To provide an illustration, consider estimating a regression coefficient to test the aforementioned hypothesis, i.e. H_{Effect}: $[Y = \alpha + \beta X + \varepsilon$ and $\beta \neq 0]$. The p-value represents the probability of

accepting the null hypothesis according to a statistical t-test, defined as $H_0: \beta = 0$, (Verbeek, 2008). Therefore, rejecting H_0 implies some effect from the independent on the dependent variable, and hence the conclusion is to accept H_{Effect}. Through selection of a confidence level, a p-value threshold is defined, below which the null hypothesis will be rejected. This provides a transparent way to reach the conclusion that the effect is significant. In this example, the regression coefficient represents what can be more generally referred to as an association, linking the dependent and independent variables in this case. A Type I error arises when an association is identified while there is none (Bandalos, 2014; Li, 2016a). Conversely, a Type II error refers to the opposite phenomenon, whereby the non-existence of an association is concluded when in reality it exists (Banerjee, 2009). Perhaps more intuitively, Type I errors are known as false-positives and Type II errors are known as false-negatives. In the regression example, rejecting H_0 and hence accepting H_{Effect}, while no real association exists between the variables, would represent a Type I error. If the converse were to happen, and H_0 was accepted implying a rejection of H_{Effect}, while in reality there was an influence of one variable on the other – this would represent a Type II error. Both of these types of error are limited in the extent that they can be addressed, but increasing sample size and other methodological decisions have the potential to minimise their likelihood (Banerjee, 2009; Bandalos, 2014; Li, 2016a).

5.2.2 Choice of estimator

An important decision to make before the application of any statistical analysis tools is choosing the right estimator (Schofield et al. 2023). In simple linear regression, one uses probit or logit estimators when the outcome variable is dichotomous, and robust-adjusted estimators in the presence of heteroskedasticity and/or non-normality (Verbeek, 2008). Similarly, different types of observed variables and samples (sample size, data asymmetry, model misspecification etc.) result in differences in the outcomes obtained with different estimators. One implicit consideration is whether the item variables, which are outcome variables in a reflective measurement model, should be treated as continuous or ordinal given they are measured on Likert scales, like in the present survey (DiStefano and Morgan, 2014; Robitzsch, 2020). Another choice that follows, is whether to use estimators that introduce corrections for robustness to non-normality (Flora and Curran, 2004; Li, 2016a). There is not much debate in the literature about the latter when considering structural equation modelling. Regardless of the decision to treat

variables as continuous or ordinal, robust corrections yield less biased estimates of standard errors, and parameter estimates (Flora and Curran, 2004; Li, 2016a).

The use of estimators tailored to ordinal data is considered the theoretically appropriate method of estimation when dealing with ordinal variables (Flora and Curran, 2004; Sullivan and Artino, 2013). However, many consider increasing the number of response categories in Likert scales to result in convergence of the results obtained from both methods of estimation as the variable approaches continuity (Wu and Leung, 2017). To this end, some suggest the use of 7-point scales, while others take their recommendation as high as 11-point scales (Joshi et al., 2015; Wu and Leung, 2017). Based on simulation studies and empirical data, it is not always clear whether taking items to be continuous or ordinal is consistently better when using Likert scales (Norman, 2010; Bandalos, 2014; Robitzsch, 2020). The former involves assuming normality of the distributions of items themselves, while the latter assumes a normal latent distribution from which the ordinal scales stem (Li, 2016a; Robitzsch, 2020). Therefore, no choice is in fact free of assumptions of multivariate normality.

Simulations have shown that in most cases using estimators tailored for ordinal variables yields less biased estimates of factor loadings, standard errors, factor covariances and structural paths, than using their counterparts where continuity is assumed (Bandalos, 2014; Li, 2016b). However, estimators tailored for ordinal data like weighted least squares (WLS) and its adjusted variants, have been found to be more sensitive to sample size, data asymmetry and model misspecification, leading them to perform worse than maximum-likelihood (ML) based estimators in controlling for Type I error and in estimating factor correlations (Bandalos, 2014; Li, 2016b). That is, under conditions of small sample sizes and high data asymmetry, least-squares based estimators seem to lead to high incidence of rejection of models that actually properly fit the data (Type I error); while ML-based estimators' performance is more consistent regardless of the setting. Conversely, other studies have found the opposite to be true, that ML-based estimators always performed worse than least-squares-based estimators in controlling for Type I error (Li, 2016b).

All statistical analysis concerning confirmatory factor analysis (CFA) was conducted using the lavaan package (Rosseel, 2012) in the open source software R. In order to increase the robustness of the results to potential biases in parameter estimates and/or Type-I errors due to the choice of estimator the model is estimated both assuming items to be continuous, which is reasonable given the 7-point Likert scales used (Joshi et al., 2015; Robitzsch, 2020) , i.e. robust

maximum-likelihood (MLM in lavaan), and as ordinal, i.e. weighted least squares with robust standard errors and mean- and variance-adjusted test statistics (WLSMV in lavaan). In both cases robust variants are used in line with their ability to consistently outperform non-robust estimators regardless of underlying conditions (Li, 2016a; Li, 2016b). WLSMV-estimated values are reported as the primary results given that the estimator produces in general, and over more conditions, less biased estimates according to simulation studies (Li, 2016b). As Bandalos' (2014) results suggest, ML estimation is more relevant in controlling for Type-I errors, than for considerations of parameter estimates.

5.2.3 Unidimensionality and model fit

Unidimensionality can be thought as a feature of a measurement model's factors. Specifically, it refers to the characteristic that measurement items loading sufficiently, and exclusively, on the factor representing the construct they intend to reflect (Churchill, 1979). One cut-off that is often employed was suggested by Hair Jr et al. (2010). It requires that standardised loadings are greater than 0.5, and ideally greater than 0.7. Additionally, error covariances of items should be zero (or really small) to indicate that all items are significantly more related to the factor in question than to any other observed or potential missing variables, a further characteristic of unidimensionality.

Unidimensionality was first considered through exploratory factor analysis (EFA) on each group of item variables which were included as part of the same construct. The results, reported in Appendix D, suggested that some items, particularly reverse-coded ones, impeded unidimensionality in the psychological distance scale. This is considered in more detail below.

Exploratory factor analysis: Inferring dimensionality from the data

In EFA, all loadings and cross-loadings, error covariances between and within factors, are freely estimated from the data. Its goal is not to test a hypothesised factor structure and hence dimensionality, but to identify the factor structure suggested by the data. This constitutes its practical difference with confirmatory factor analysis (CFA), where unidimensionality is assumed, such that each item is taken to load only on its hypothesised latent factor. Therein lies the foundation of confirming the unidimensionality of factors with CFA: Does the model where factors are restricted to fulfil unidimensionality present sufficiently good fit to the data? Then, in CFA, through a restricted model where all items load freely exclusively on their corresponding factor, and all item error covariances are fixed to zero, in order to confirm imposed unidimensionality.

An EFA was conducted on all the constructs that were measured reflectively in the experiment (see Appendix D). This involved the refinement of the scale through removal and replacement of items based on factor loadings and communalities. In particular, for a sample of around 200 participants, Hair Jr et al. (2010) proposes that factor loadings as low as 0.4 can be considered significant for interpretive purposes. This is used as a guideline for the EFA concerning the internal intentions (INT) scale, which has not been previously applied and on which no particular factor structure was hypothesised. Then the more stringent cut-off of 0.5 is chosen in order to confidently meet this criterion, even if values were to approach this value. This is a reasonable requirement based on Hair Jr et al.'s (2010) recommendation and since the scale is exploratory in nature, such that some additional noise can be expected compared to previously validated scales. On the other hand, adapted and validated scales, psychological distance (PD), dispositions toward sustainable consumption (DSC) and, intentions to consume more sustainably (BISUST) and to consume less (BIRED), are expected to perform better. Therefore, more stringent conditions are placed such that factor loadings of at least 0.7 were required for significance (Hair Jr et al., 2010).

Communalities represent the amount of shared variance between an item and the factors it loads on. It is computed as the sum of squared factor loadings across all the factors on which it loads. They are often used at EFA stage to refine the items included, often leading to subsequent reduction of factors (Hair Jr et al., 2010). Communalities as low as 0.2 have been suggested as acceptable at the factor reduction stage (Child, 2006). However, typically more stringent 0.4 cut-off has been proposed as more generally acceptable, while values around and above 0.5 are desirable (Hair Jr et al., 2010; Costello and Osborne, 2019). Similar to the factor loadings, separate communality cut-offs were imposed on exploratory, against validated, constructs. In the former, the imposed cut-off was 0.3, hence still above the smallest cut-off recommended in the literature, but slightly more forgiving than the typical 0.4 cut-off. For validated and adapted scales, a communality of at least 0.45 was required to retain items, in line with Tabachnick, Fidell and Ullman 's (2013) recommendation.

The exploratory INT construct was assessed for factor structure based on factor loadings and communalities as described above. The resulting scale retained 4 of the original 8 items due to low communalities and in some cases what is known as 'Hayewood' cases (Cooperman and Waller, 2022). In these, the estimated standardised factor loading exceeds 1, implying a negative error variance which is generally problematic due to model misspecification, sampling errors and

other potential issues (Chen et al., 2001). This can be addressed only when there exists a theoretical rationale for expecting the error variance to be zero, and only if it can be further justified through model comparisons of the unrestricted and restricted models (Van Driel, 1978). This is not the case with this scale, particularly since it is treated as exploratory. The resulting scale met the criteria of unidimensionality imposed.

All of the DSC, BISUST and BIRED scales successfully met the criteria for unidimensionality. Particularly, dispositions toward sustainable consumption performed exactly as expected given that it has been stringently validated, resulting in the same 6-item scale (Haws, Winterich and Naylor, 2014). The (external) intentions items, i.e. BISUST and BIRED, were jointly assessed with items referring to intentions to produce less waste. No cross-loading issues arose once the items referring to intentions to produce less waste had been removed due to cross-loading significantly on the BISUST factor. While the waste-reduction intentions items are not reported here, an initial indication of this phenomenon had been observed in previous preliminary work using the same data (Georgantzis Garcia et al., 2022). The result are two 3-item factors whose items load highly on their own construct and no cross-loadings were observed (Appendix D).

While Wang's (2019) instrument offers a good representation of several dimensions of psychological distance, it contains several reverse-coded items. Recent empirical findings suggest these type of questionnaire items can be particularly problematic when administered in Spanish (Venta et al., 2022). The EFA results aligned with this phenomenon as reverse-coded items failed to meet loading and communality thresholds described in this section. Therefore, these were removed, which affects the representation of each dimension of psychological distance in the scale. This was expected to be problematic since it naturally shifts the content of the scale away from the least represented dimensions and toward the highly represented ones, affecting content validity of the scale. Therefore, the factor is expected to represent one of the dimensions most closely (the social dimension in this case) and this can manifest in other items not sharing enough variance with the factor to pass construct validity assessments. This was also confirmed through EFA where items corresponding to underrepresented factors fell under the required factor loading and communality cut-offs of 0.7 and 0.45, respectively. In light of these observations, the scale was reduced to only the 4 social dimension items (from originally containing 18 items pertaining to the four dimensions of psychological distance and their intersections) to increase the concreteness of the construct, and in turn its content validity.

While removing all other dimensions can reduce the breadth of the construct, parallel analysis of all the items and EFA (including reverse-coded ones) revealed several separate factors on which different items loaded (Appendix D). However, a minimum of three items per factor is considered good practice in order to ensure over-identification, i.e. having more observed than estimated parameters (Hair Jr et al., 2010; Tabachnik and Fidell, 2013). This ensures a positive number of degrees of freedom, necessary for any chi-square-based model fit index to be computed. Therefore, a minimum of three items for each dimension of the multidimensional psychological distance factor should be available. This was made impossible by the problem of reverse-coded items which presented very poor coherence to other items in the scale.

The social dimension is particularly relevant to the behavioural context of interest, since psychological distance from climate change in the social dimension is the most closely translatable to the experimental context. This is because there is more space for individual opinion on how the outcomes of the experiment may affect one's self and others. For example, the spatial dimension is not really incorporated in the experimental world, the time dimension is included but only at 'model' scale (only 30min-1h), and the hypothetical dimension is much more deterministic than in the case of climate change. Therefore, on the grounds of face and construct validity, and coherence with the behavioural setting, the use of a reduced 4-item instrument using only the social dimension of psychological distance to operationalise psychological distance in this research is justified.

In sum, A reduced version of the scale was used, using no reverse-coded items, which have been found to be problematic in general and potentially even more so when administered in Spanish (Venta et al., 2022). Since the psychological distance scale addresses several dimensions at once, the removal of reverse-coded items resulted in a disproportionate representation for each dimension, which was also apparent from EFA results, hence affecting face validity of the construct. These considerations lead to a psychological distance scale which is focused on the social dimension primarily, which is justified empirically by EFA, and theoretically in terms of content and face validity. The EFA (Appendix D), points to proper unidimensionality of all constructs.

Model fit

Assessing model fit is one of the two central considerations necessary in considerations of measurement model validity, the other one being construct validity checks. The former addresses

the question of whether a particular model makes predictions that are sufficiently close to what was actually observed, i.e. the data itself. In the context of confirmatory factor analysis (CFA), the goal is to confirm some measurement model. An assessment of model fit in this context partly means assessing for unidimensionality of the factors, since this condition is imposed. While good model fit cannot provide certainty about unidimensionality, which is the case with most statistical tests, it still is a necessary condition. It would be difficult to argue for unidimensionality of the factors with a model that fits the data poorly.

A chi-square-based statistical test for the closeness of the observed covariance matrix with that which is estimated, as implied by the theoretical model, is at the core of model fit assessment in structural equation modelling (SEM) and CFA. Here, the null hypothesis is that the observed and estimated covariance matrices are equal. Thus, a statistically significant chi-square statistic indicates poor fit. However, the test's significance is highly dependent on sample size making it impractical for large sample sizes, which are otherwise desirable (Hair Jr et al., 2010). Therefore, the chi-square test is rarely the sole indicator of model fit reported in the literature (Goretzko, Siemund and Sterner, 2023). On the basis of alternative fit indices, (such as the ones discussed below) and sample size, failing the chi-square test alone is not considered sufficient proof of poor model fit to reject a CFA (or SEM) model.

There exist numerous fit indices that can be used to assess model fit in the context of CFA and SEM, the majority of which use the chi-square statistic as a starting point (Netemeyer, Bearden and Sharma, 2003; Hooper, Coughlan and Mullen, 2008; Bollen, 2011). Usually the distinction is drawn between incremental fit indices, which rely on a comparison of the fitted model with a base model (which may vary between indices), and absolute fit indices, which use a comparison to no model at all (totally unrestricted) (Widaman and Thompson, 2003; Hair Jr et al., 2010; Goretzko, Siemund and Sterner, 2023). The former are goodness of fit measures, with larger values relating to better fit, while the latter are badness of fit measures, with lower values indicating better fit (Marsh, Balla and McDonald, 1988; Netemeyer, Bearden and Sharma, 2003; Bollen, 2011). Thus, absolute fit indices are most direct in testing for the model's ability to replicate the data, while incremental fit indices assess model fit relative to certain alternative specifications (Widaman and Thompson, 2003; Hair Jr et al., 2010).

Construct	Items	M	SD	λ
Dispositions towards sustainable consumption (DSC) – Haws, Winterich and Naylor (2014)	1. It is important to me that the products I use do not harm the environment.	5.44	1.23	0.83
	2. I consider the potential environmental impact of my actions when making many of my decisions.	5.14	1.51	0.83
	3. My purchase habits are affected by my concern for our environment.	4.60	1.54	0.81
	4. I am concerned about wasting the resources of our planet.	5.69	1.27	0.80
	5. I would describe myself as environmentally responsible.	4.86	1.25	0.70
	6. I am willing to be inconvenienced in order to take actions that are more environmentally friendly.	5.00	1.34	0.76
	Cronbach's alpha = 0.89 Composite reliability = 0.89 Average variance extracted = 0.62			
Psychological distance to climate change (PD) – Wang (2019)	1. I don't see myself as someone who will be affected by climate change.	2.63	1.69	0.83
	2. Serious effects of climate change will mostly affect people who are distant from me.	2.84	1.80	0.75
	3. My family and I will be safe from the effects of climate change.	2.49	1.46	0.91
	4. It is virtually certain that my family will be safe from the effects of climate change.	2.74	1.60	0.81
	Cronbach's alpha = 0.85 Composite reliability = 0.86 Average variance extracted = 0.68			
Intentions to consume more sustainably (BISUST) – External to the experiment - Adapted from (Li et al., 2018; Si et al., 2020)	1. I would like to consume products and services in a sustainable way in the future.	6.12	0.98	0.90
	2. I will try to consume products and services in a sustainable way in the future.	5.90	1.11	0.95
	3. I will insist on consuming products and services in a sustainable way in the future.	5.57	1.27	0.90
	Cronbach's alpha = 0.90 Composite reliability = 0.91 Average variance extracted = 0.84			
Intentions to reduce	1. I would like to consume less in the future.	5.37	1.42	0.92
	2. I will try to consume less in the future.	5.37	1.39	0.93

Construct	Items	M	SD	λ
consumption (BIRED) – External to the experiment - Adapted from (Li et al., 2018; Si et al., 2020)	3. I am willing to consume less in the future.	5.40	1.35	0.86
	Cronbach's alpha = 0.91 Composite reliability = 0.91 Average variance extracted = 0.82			
Intentions to behave selfishly (INT) – Internal to the experiment[9]	1. I would intend to behave so as to profit as much as possible, without consideration for other members of the group.	2.65	1.48	0.73
	2. I would extract as much as possible from the resources.	3.42	1.91	0.67
	3. I would extract as much as possible from the resources, as long as the probability of the world ending is low enough.	4.39	1.71	0.63
	4. The most important thing for me would be to benefit as much as possible from the resource.	3.37	1.68	0.63
	Cronbach's alpha = 0.73 Composite reliability = 0.73 Average variance extracted = 0.44			

Table 13. Measurement model confirmatory factor analysis (CFA) (scaled chi-square= 359.063[p=0.000], d.f.=160, RMSEA=0.065; SRMR=0.053; CFI=0.977; TLI=0.973). All items are measured on a 7-point Likert scale, where higher scores imply an increasing degree of agreement with the statement, relative to lower scores. Cronbach's alpha (α), composite reliability (CR) and average variance extracted (AVE) are reported for each construct. M – mean. SD - standard deviation. λ – standardised factor loadings from the CFA model including all factors, and using the WLSMV estimator, a robust variant of the diagonally-weighted least squares estimator, which treated item variables as ordinal. (U) – Unused in the estimation of the CFA model. NA – not applicable.

It is usually suggested that multiple indices of different types are reported to support model fit. Hair Jr et al. (2010) propose that in addition to the chi-square value and the degrees of

[9] Items in the INT scale were preceded by (and pertain to) the following text: following text: "*A hypothetical situation is described below. Please answer the following questions considering, as accurately as possible, how you would act if you were personally in the described situation.*

Imagine a scenario where you can benefit from a range of renewable resources that are necessary and shared with a group of people. However, because these resources are limited, the more quickly and extensively you use them, the less the other members of the group will be able to enjoy their benefits. Additionally, as the resources become depleted, the likelihood of a catastrophe occurring and the world ending for everyone increases. To what extent do you agree with the following statements?"

freedom of the model, at least one index of absolute fit, and one of incremental fit, should be reported. In compliance with this proposition, the most commonly used incremental fit indices were reported, namely comparative fit index (CFI) and Tucker-Lewis index (TLI), as well as the two most commonly reported absolute fit indices, root mean squared error of approximation (RMSEA) and standardized root mean square residual (SRMR) (Goretzko, Siemund and Sterner, 2023).

Hair Jr et al.'s (2010) sample-size- and model-complexity-adjusted cutoffs are employed to assess the CFA model's fit. This is important because the tendency of fit indices to wrongly accept or reject the proposed models is significantly impacted by these parameters (Goretzko, Siemund and Sterner, 2023; Netemeyer, Bearden and Sharma, 2003). The proposed cutoffs for sample sizes larger than 250 (here n=295), and models containing 12<m<30 observed variables (here m=17). These suggest that a significant chi-square statistic is to be expected (and not a sign of lack of fit), CFI and TLI should exceed 0.94, and conditionally on the CFI criterion being met, RMSEA should not exceed 0.07 and SRMR should be below 0.08 (Hair Jr et al., 2010).

In the model, all typically reported incremental fit indices (CFI=0.977; TLI=0.973) and absolute model fit indices (RMSEA=0.065; SRMR=0.053) indicate good model fit, also offering support for constructs' unidimensionality.

5.2.4 Convergent validity

Convergent validity refers to the extent to which a scale measures what is intended conceptually (Netemeyer, Bearden and Sharma, 2003). To satisfy this, indicators that measure the same latent factor must show a significant degree of convergence, such that the amount of shared variance is high (Hair Jr et al., 2010). Conceptually this simply means that, since the measurement model precisely posits that these items are good enough observable representations of some latent construct, all items are expected to be highly dependent on the same latent factor, and hence share a high proportion of their variance.

There are several checks for convergent validity several of which should all be looked at in parallel in order to be able to conclude that a given measurement model fulfils the required standards (Campbell and Fiske, 1959). The convergent validity checks that are typically reported in psychometric research are: factor loadings, AVE, composite reliability (CR) and Cronbach's alpha (α) (Hair Jr et al., 2010; Hair Jr et al., 2021). These values are reported for each of the constructs in Table 13, and discussed in detail in the following sections. First, the measures of

internal consistency reliability, Cronbach alpha and composite reliability, as well as average variance extracted, are explained below.

Reliability is a measure of the consistency of a scale in measuring a concrete construct rather than some diffuse notion overlapping with others. To assess this for the scales used in the confirmatory factor analysis (CFA), Cronbach's alpha and the composite reliability are considered:

- Cronbach's alpha (α) is the most widely used indicator of reliability, partly because it is not specific to the context of structural equation modelling (SEM) (Cronbach, 1951; Padilla and Divers 2016). It is measure of the internal consistency of a scale. This measure has been shown to represent effectively a lower bound on the actual reliability of a scale, since it is constrained to provide values lower than the actual reliability (Sijtsma, 2009). It is sometimes argued, this is a good feature, since it can only improve the quality of research by incentivising the application of further care for reliability. However, this logic is flawed given that it increases the risk of rejecting a scale that performs acceptably, i.e. a Type II error (Sijtsma, 2009). Therefore, composite reliability is also considered to establish internal consistency of the scales.
- Composite reliability (CR) is calculated using the following formula (Jöreskog, 1971; Netemeyer, Bearden and Sharma, 2003):

$$CR = \frac{(\sum_{i=1}^{n} \lambda_i)^2}{(\sum_{i=1}^{n} \lambda_i)^2 + (\sum_{i=1}^{n} e_i)} \quad \text{Eq. (2)}$$

  where λ_i and e_i are item i's factor loading and error variance, respectively. CR is also considered a measure of internal consistency of a scale. As shown by its formula, it is a ratio of the variance shared between the item and the factor, to the total variance obtained by adding the item's error variance. In contrast to α, CR is extracted from the CFA model and provides a measure of reliability, rather than a lower bound (Padilla and Divers 2016). In particular, it takes into account factor loadings for each item rather than assuming them to be equal for all items (Hair Jr et al., 2010). These features make it the preferred measure of internal consistency reliability, especially in SEM analysis contexts (Padilla and Divers 2016). Values for both coefficients are reported in Table 13 for all constructs in the CFA model.

Another important measure in the assessment of convergent validity is average variance extracted, which as its name suggests, quantifies the average portion of variance in the in the items explained by the factor on which they load.

- Average variance extracted (AVE) is yet another measure of convergent validity. It is the mean of the variance extracted (communalities) of all items in a scale, and provides an overall indication of the scale's items' convergence (Fornell and Larcker, 1981; Hair Jr et al., 2010). It is calculated from standardised factor loadings, λ_i (where i indexes items in the scale), as follows:

$$AVE = \frac{\sum_{i=1}^{n}(\lambda_i{}^2)}{n} \quad \text{Eq. (3)}$$

It is proposed in the literature that, on average, most of the variance in the observed indicators should be explained by the latent construct (Netemeyer, Bearden and Sharma, 2003). This implies that desirable AVE values must be at least 0.5, such that the aforementioned condition is met (Hair Jr et al., 2010). Values of AVE below this threshold imply that, on average, more of the variance in the items is due to error than that which is explained by the latent construct.

The following section considers the role of factor loadings in convergent validity assessment and describes the findings of the CFA model relative to extant guidelines.

Factor loadings

In the measurement model, items reflect their underlying construct since they are used as observable manifestations of their latent factors. This is called reflective measurement, and the converse would be formative measurement, where the factors are not latent in the same sense since they are fully defined by the underlying items (Diamantopoulos, 2011). In fact, given a formative measurement model, considerations of convergent validity are less relevant conceptually (Bollen, 2011). As Diamantopoulos (2011) explains, being reflective or formative is not a feature of the construct itself, but of measurement, and the choice of either should be made on the basis of definition and conceptualisation. The choice in this case is straightforward since the measurement items in this analysis are taken to correspond to manifestations, through self reports, of some underlying psychological construct – hence better aligning with the conception of reflective measurement.

Factor loadings, λ, in the confirmatory factor analysis (CFA) model are standardised, in other words, factors' variances are all fixed to 1. This effectively sets the scale such that $\lambda \in [0,1]$. Values greater than 1 can sometimes happen, implying a negative error variance, which cannot be conceptually understood (Cooperman and Waller, 2022). These are sometimes called 'Hayewood' cases, and although sometimes they can be addressed on theoretical grounds, in general they are considered improper solutions which may indicate model misspecification, sampling errors and other problems (Chen et al., 2001).

When considering convergent validity, factor loadings should be large enough such that they can be considered a valid reflection of the construct being measured. Some rules of thumb that are typically employed in the literature are: Hair Jr et al.'s (2010) proposition that factor loadings should be at least greater than 0.5, and preferably greater than 0.7. Others have explored

the relationship between sample size, number of items and the size of factor loadings, leading them to propose a sample-size independent cut-off of 0.6 (for 4-item scales) (Guadagnoli and Velicer, 1988; Field, 2013).

As shown in Table 13, the loadings in the CFA model range between 0.63 and 0.95, showing that all the items fulfil both recommendations found in the literature. Namely, all loadings are at least greater than 0.6, and in 17 out of 20 cases they are also greater than the *ideal* cut-off of 0.7. The slightly lower loadings are all found in the INT scale. This was to be expected because the scale could not have been validated previously, and is exploratory in nature as explained in the previous section, since it was specifically about the experimental setting participants would find themselves in. Therefore, given that it stems from a rather exploratory analysis, some lower loadings could have been expected. Moreover, the dependence of responses to comprehension and interpretation of the hypothesised behavioural context which is described, is also expected to contribute to the emergence of more varied (i.e. less consistent) responses. When considering only adapted and validated measures, the minimum loading observed was 0.7, which is exactly at the 'ideal' threshold proposed by Hair Jr et al. (2010).

Cronbach's alpha and composite reliability

Reasonable values of composite reliability (CR) range from 0.6, which is proposed by Hair Jr et al. (2010) for exploratory research, where construct definition is more diffuse in nature, to 0.8 which Netemeyer, Bearden and Sharma (2003) propose as a threshold for concretely defined constructs (with five to eight items). As a general guideline, Hair Jr et al. (2010), propose that values above 0.7 can be considered a reasonably good indication of sufficient reliability. Moreover, CR values greater than 0.95 could be considered problematic as it may point towards a significant degree of overlap or redundancy in the measurement items (Hair Jr et al., 2010). As illustrated by these claims, reliability coefficients cannot be considered independent of concreteness in the definition of the scale, which fundamentally separates exploratory and confirmatory research, such that higher reliability expectations go in hand with narrower conceptualisations. Given that Cronbach's alpha (α) represents a lower bound on the reliability of a scale, rather than an approximation of the actual value, cutoffs must be equal or lower to those specified for CR, in order to make these coherent. In the present analysis, the same cutoff values are employed, such that the 0.8 threshold meets recommendations in the literature for concretely defined and validated scales for both CR and α (Clark and Watson, 1995; Netemeyer, Bearden and Sharma,

2003). At the same time, the 0.7 threshold for exploratory scales represents a relaxation with respect to this value, but is still more stringent than the lowest threshold proposed for CR, of 0.6, specifically for exploratory scales.

As shown in Table 13, values of α and CR are very similar in all cases (but the latter is necessarily equal to, or greater than the former). Values of CR for the constructs range between 0.73 and 0.91, hence surpassing the general 0.7 cut-off. Not surprisingly, the more exploratory in nature, and hence less narrowly defined construct, INT, is the only construct which does not also meet the more stringent criterion of being greater than 0.8. However, given that it is made out of four items and is exploratory in nature, this is not considered problematic as it is still above the 0.7 threshold, and well above the more relaxed 0.6 cut-off proposed for exploratory research (Hair Jr et al., 2010). Moreover, all other scales are highly reliable, without going above the 0.95 mark which could raise questions about item redundancy. On these grounds, it is concluded that all the scales exhibit satisfactory levels of internal consistency reliability, as evidenced through both α and CR.

Average variance extracted

Four of the five constructs in the measurement model have average variance extracted (AVE) values ranging from 0.62 to 0.84, as shown in Table 13. These constructs by far meet the >0.5 requirement, pointing towards satisfactory convergence of the scales. The remaining construct, INT, has an AVE value of 0.44, meaning that (on average) 56% of the variance in the observed variables is due to error. It must be acknowledged that this could point at a weakness in the scale. However, it must also be noted that AVE is very sensitive to the number of items with loadings smaller than or equal to 0.7. That is, since $0.7^2=0.49$, any additional term in the sum of squared loadings used to compute the AVE will contribute to reducing its value (since it lies below 0.5 and an average is being computed), despite exhibiting the desired behaviour in terms of factor loading size. For example, consider removing one of the items in the INT construct with a loading of 0.63, AVE would increase to 0.46, despite the factor loading being comfortably above the typical 0.6 threshold. The goal, however, is not to increase a single indicator such as AVE, but to assess the quality of the scale taking into account all available indicators of convergent validity, together with its origins and context.

Considering all things together, all INT items neatly satisfy the usual psychometric standards for factor loadings being above 0.6, and have a CR of 0.73, well above the exploratory

threshold (0.6) and even above the general threshold (0.7) proposed by Hair Jr et al. (2010). Most importantly, there is good conceptual reason to relax this requirement based on content validity, the fact that it is a new scale, and on the hypothetical context in which the questions are set. The extra item adds information to the measurement model which improves content validity of the scale. Since, due to the research design of the present Thesis, the underlying factor of the scale was not theorised, but identified through EFA, it is to be expected that more error may be introduced. Finally, questions were about a hypothetical world which mimicked the one participants would later on engage in during the experiment. However, at the hypothetical stage, each individual may introduce slightly further error due to interpretation of the behavioural setting in question. Moreover, Netemeyer, Bearden and Sharma (2003) propose that newly developed scales with AVE values approaching 0.5, greater than 0.45 seem reasonable. The 0.44 value computed for the INT scale falls just a 0.01 point away from this arbitrary threshold. All these considerations taken together lead to the conclusion that, while not meeting the 0.5 cut-off for AVE, maintaining the scale is more reasonable than altering or removing it. This is further argued below.

Fornell and Larcker (1981) pointed out that AVE is a conservative measure relative to loadings and other reliability coefficients, and that on the basis of CR one may be able to establish convergent validity. The previous consideration of the effect of additional items with factor loadings ≤ 0.7 illustrates this. While factor loadings above 0.6 can generally be considered valid by typical standards, even when there are just 4 items with the same loading size, this would lead to an AVE of 0.36 in a one-factor model like the INT scale (Field, 2013). On the other hand, a scale with 10 items is expected to lead to a relaxation of the requirements for establishing reliability, with some considering even 0.4 a high enough value (Guadagnoli and Velicer, 1988). It follows from Eq. 3 above, however, that this would contribute to a harsh drop in AVE, making these views incompatible. As the cut-offs for factor loadings are adapted/relaxed for exploratory research with less concrete construct definitions, given that AVE is just an average of the squared factor loadings, this must mathematically lead to a proportional adaptation of the requirements for a scale's AVE. Such an adaptation must still be supported on theoretical and conceptual grounds, as well as on other reliability assessments. This is in line with Netemeyer, Bearden and Sharma (2003), who suggest a relaxation of the AVE threshold, and provide an example of >0.45, when a newly developed scale is being assessed. Therefore, based on several aspects that have been discussed above (good factor loading values, CR, content validity, research-design imposed

limitations, adapting the cut-off to a newly developed scale, and potentially biased interpretations of a hypothetical setting), it is concluded that an AVE of 0.44 is not to be considered problematic, and is not even unexpected, given the circumstances. Finally, this indicator (AVE) alone is not considered to provide a sufficiently strong basis for the withdrawal, or even alteration, of the INT scale from the model.

Concluding remarks on convergent validity

Based on factor loadings, reliability coefficients (α and CR), and AVE, convergent validity was established for all constructs in the measurement model. The lower than ideal AVE value of INT is acknowledged, while noting that it still falls very close to expectations adapted to newly developed scales (Netemeyer, Bearden and Sharma, 2003). Moreover, it was concluded that convergent validity of the aforementioned construct may be established on the basis of other reliability and convergence measures, as well as, content validity and the adaptation of expectations (or cut-off values) in the presence of wider/more diffuse exploratory construct definitions, and newly developed scales.

5.2.5 Discriminant validity

Convergent validity is concerned with the question of whether items of the same factor are sufficiently similar to be measuring the same construct. In contrast, discriminant validity relates to the assessment of whether factors in the measurement model are sufficiently different from one another to actually be measuring different constructs.

The most prominent discriminant validity check is the FL criterion (Fornell and Larcker, 1981), which requires that constructs' AVE is greater than the square of inter-factor correlations. This was checked and confirmed for all pairs of factors in the confirmatory factor analysis (CFA) model (Table 14). On the other hand, the FL criterion (Rönkkö and Cho, 2022) has recently been critiqued on grounds that the test is severely biased and arbitrary, rather than 'conservative', which leads to a high incidence of Type II errors. Rönkkö and Cho (2022) propose a classification system for establishing levels of discriminant validity which they show to better align with the methodological definition of the discriminant validity concept and its continuous nature. The classification is based on sequentially considering factor correlations, and changes in chi-squared when comparing the fitted model with a nested model where factor correlations are constrained to high values (0.8, 0.9 or 1). The classification criteria are shown in Table 15 below. It is important

to note, that the confidence-interval workflow (CI_{CFA} (sys)) is applied first, providing its results as input for the chi-square workflow (χ^2(sys)) classification (Rönkkö and Cho, 2022).

	INT	BISUST	BIRED	PD	DSC
INT	0.44				
BISUST	0.04	0.84			
BIRED	0.07	0.34	0.82		
PD	0.09	0.20	0.15	0.68	
DSC	0.07	0.45	0.26	0.13	0.62

Table 14. Squared inter-factor correlations (non-diagonal elements) and average variance extracted (diagonal elements).

As shown in Table 16, all pairs of constructs in the measurement model fall under the "No problem" class under the CI_{CFA} (sys) workflow (Table 15). The highest CI limit value (i.e. upper limit when $\rho_{CFA} > 0$, and the absolute value of the lower limit when $\rho_{CFA} < 0$) of 0.734, was found between dispositions toward sustainable consumption and BISUST, and is therefore smaller than 0.8. For the χ^2(sys) workflow all chi-square differences were highly significant (p-value=0.000, rounded to three decimal places) with the lowest difference being $\chi^2_{0.8} - \chi^2_{OG}$ = 17.45, which is well above the 3.84 mark proposed by Rönkkö and Cho's (2022) as the cut-off. Therefore, all pairs of constructs fall within the "No problem" in the χ^2(sys) workflow too.

Classification	**CI_{CFA} (sys)**	**χ^2(sys)**
No problem	UL < 0.8	$\lvert\rho_{CFA}\rvert$ < 0.8 AND $\chi^2_{0.8} - \chi^2_{OG}$ > 3.84
Marginal problem	0.8 ≤ UL < 0.9	Not "No problem" AND $\chi^2_{0.9} - \chi^2_{OG}$ > 3.84
Moderate problem	0.9 ≤ UL < 1	Not "Marginal problem" AND $\chi^2_1 - \chi^2_{OG}$ > 3.84
Severe problem	1 ≤ UL	$\chi^2_1 - \chi^2_{OG}$ < 3.84

Table 15. Discriminant validity classification (Rönkkö and Cho, 2022). Where CI_{CFA} (sys) and $\boldsymbol{\chi^2}$(sys) refer to the confidence-interval and chi-square comparison workflows, respectively. ρ_{CFA} is the correlation implied by the CFA model. UL is the upper limit when $\rho_{CFA} > 0$, and the absolute value of the lower limit when $\rho_{CFA} < 0$, of the 95% confidence interval for ρ_{CFA}. $\boldsymbol{\chi^2_{OG}}$ is the chi-square value of the original model, and $\boldsymbol{\chi^2_c}$ is the chi-square value of the comparison model where the inter-factor correlation is fixed to $\boldsymbol{c}$ when $\rho_{CFA} > 0$ and $-\boldsymbol{c}$ when $\rho_{CFA} < 0$.

Rather than making an argument against the FL criterion by using the classification system of Rönkkö and Cho's (2022) to test for discriminant validity (Table 15), the latter was incorporated in addition to the first (Table 14). These tests in general can identify when there is evidence of a problem, but cannot be taken to confirm the lack of one. Given the prominence of recent methodological critiques of the FL criterion, applying several tests is particularly relevant to

support claims that discriminant validity is met. In the CFA model, all three criteria found no evidence of a problem related to the discriminant validity of the scales. That is, the FL criterion was met for all construct pairs (Table 14), and they all unambiguously fell under the "No problem" category in Rönkkö and Cho's (2022) classification (Tables 15 and 16).

Factor 1	Factor 2	ρ_{CFA}	Lower (95% CI)	Upper (95% CI)	$\chi^2_{0.8} - \chi^2_{OG}$	p-value
PD	DSC	-0.362	-0.462	-0.262	77.200	0.000
PD	BISUST	-0.447	-0.540	-0.355	59.113	0.000
PD	BIRED	-0.387	-0.492	-0.282	62.123	0.000
PD	INT	0.292	0.175	0.408	78.533	0.000
DSC	BISUST	0.670	0.607	0.734	17.449	0.000
DSC	BIRED	0.512	0.426	0.597	47.548	0.000
DSC	INT	-0.265	-0.380	-0.150	98.085	0.000
BISUST	BIRED	0.586	0.511	0.662	33.383	0.000
BISUST	INT	-0.201	-0.328	-0.074	85.199	0.000
BIRED	INT	-0.265	-0.378	-0.152	89.050	0.000

Table 16. Checking for discriminant validity in the measurement model using Rönkkö and Cho's (2022) classification system. Factor 1 and Factor 2 – The two constructs which are tested for discriminant validity (order is not important as it is correlation based). ρ_{CFA} is the correlation between the two factors implied by the CFA model. Lower (95% CI) – lower bound of the 95% confidence interval for ρ_{CFA}. Upper (95% CI) – upper bound of the 95% confidence interval for ρ_{CFA}. $\chi^2_{0.8} - \chi^2_{OG}$ is the chi-square difference between the restricted model, where inter-factor correlations are fixed to 0.8, and the unrestricted original CFA model.

5.2.6 Nomological validity

Nomological validity is the third main type of construct validity that requires attention (Heale and Twycross, 2015). It refers to the feature of empirically relating to other constructs in ways that are expected theoretically. In other words, it is assessed against a set of hypotheses about the effects of changes in one construct, on other theoretically relevant constructs (Hair Jr et al., 2010). At the confirmatory factor analysis (CFA) stage, inter-factor correlations are a first indication of nomological validity, while the structural equation model (SEM) offers greater resolution as a test of theoretical hypotheses. A summary of the hypotheses relevant to this, and latter sections of this chapter's analysis is provided in Table 17.

#	Hypotheses	Factors
H1	Intentions' influence on behaviour is mediated by other intentions that are framed less abstractly.	BISUST, BIRED, INT

#	Hypotheses	Factors
H1a	The mediation effect of more concrete intentions, in the relationship between more abstract intentions and behaviour, is positive.	
H2	More concretely framed intentions have a stronger total effect on actual behaviour than more abstract framings.	
H2a	The total effect of any framing of intentions on actual behaviour is non-negative. In other words, it is either positive or non-significant (i.e. not sufficiently different from zero).	
H3	The relationship between psychological distance and intentions is stronger the more concrete the framing of intentions.	PD, BISUST, BIRED, INT
H4	The total effect of psychological distance to climate change on actual behaviour is negative.	PD
H5	Dispositions toward sustainable consumption positively influence behavioural intentions.	DSC, BISUST, BIRED, INT
H5a	The effect of dispositions toward sustainable consumption on intentions is stronger the more abstract their framing.	
H6	The total effect of dispositions toward sustainable consumption on actual behaviour is non-negative.	DSC
H7	Psychological distance to climate change mediates the effect of dispositions toward sustainable consumption on intentions.	PD, DSC, BISUST, BIRED, INT
H7a	Psychological distance to climate change negatively predicts intentions.	PD, BISUST, BIRED, INT
H7b	Dispositions toward sustainable consumption negatively predict psychological distance to climate change.	PD, DSC
H17	Being female predicts higher dispositions toward sustainable consumption, relative to being male.	DSC
H18	Being female predicts shorter psychological distance to climate change, relative to being male.	PD
H19	Being female predicts higher levels of intentions to behave sustainably, relative to being male.	BISUST, BIRED, INT
H19a	The positive effect of being a female, relative to being male, on intentions is stronger the less concrete their framing.	BISUST, BIRED, INT
H20	The total effect of being female on SCB, relative to being male, is positive.	-
H21	Risk aversion positively influences sustainable consumer behaviour.	-
H22	Concrete intentions mediate the relationship between risk aversion and behaviour.	-
H22a	The mediation effect of concrete intentions in the relationship between risk aversion and behaviour is positive.	BISUST, BIRED, INT

Table 17. Summary table of hypotheses, relevant to confirmatory factor analysis (CFA) and structural equation model (SEM) analysis. All hypotheses were introduced and explained in detail in Chapter 3. Columns

are as follows: '#' - Hypothesis number/code. 'Hypotheses' – Statement of each hypothesis. 'Factors' – Lists the factors from the measurement model that are involved in each hypothesis, serving as a basis for nomological validity checks of the scales.

Factor correlations for all pairs of constructs in the CFA model are shown in Table 16 (ρ_{CFA}). First, all values have the expected sign. Since increased psychological distance is associated with lower pro-environmental attitudes, intentions and behaviour a negative sign is expected (H4 and H7a in Table 17). The same goes for INT, which are negatively framed (i.e. behaving selfishly), relative to other measures of intentions (BISUST and BIRED) (H1 and H1a in Table 17). Since operationalisation of INT is negative relative to sustainable consumer behaviour (SCB), due to its exploratory origin, hypothesised signs must be inverted when involving INT in order to maintain the same conceptual meaning. Therefore, all correlations involving either psychological distance or INT, and any other construct should be negative, while the correlation between psychological distance and INT is expected to be positive (negative-negative implies positive). Dispositions toward sustainable consumption are expected to correlate positively with all intentions factors (except INT whose expectation should be inversed as previously explained) and negatively with psychological distance (H5 and H7a in Table 17). These expectations were satisfied for all pairs of constructs.

Moreover, dispositions toward sustainable consumption correlates higher with intentions as their abstraction increases, as expected (H5a in Table 17). psychological distance correlated higher with more abstract intentions, which is not what is expected at the structural level, but could still be in coherence with the hypotheses given that correlations do not explicitly account for mediation effects (which is the central feature of psychological distance targeted by the developed hypotheses), or other control variables (H3 in Table 17). Finally, more abstract intentions correlated higher amongst each other than with more concrete constructs, such that BISUST and BIRED correlated higher than BISUST and INT, and BIRED correlated higher with INT than its more abstract counterpart, BISUST. This was expected based on H1 in Table 17. These observations successfully reflect nearly all the theoretical expectations, while the only expectation that was not met refers to nuanced structural relationships which a simple inter-factor correlation is not capable of manifesting.

In sum, inter-factor correlations in the model offer preliminary support for nomological validity of all the scales. Only psychological distance did not relate to intentions as expected in terms of dynamics relative to varying abstraction. However, this is not a call for concern, since

simple correlations are not expected to capture complex structural effects where many factors interact in intricate manners (like hypotheses about these relationships imply). In the following section, the SEM is introduced, aiming to test the theoretical hypotheses that do not involve institutional setting, which will serve as a more nuanced assessment of the nomological validity of the constructs. As it is shown below, the results support nomological validity of all the scales.

5.3 A structural model of sustainable consumer behaviour

Having addressed the question of construct validity through confirmatory factor analysis (CFA), the validated measures are now used to build a structural equation model (SEM). In contrast to CFA, in SEM, causal links implied theoretically are modelled, i.e. the hypotheses presented in Table 17. As such, it is no longer assumed that all factors (just) covary amongst each other like in CFA, instead a network of causal links deduced from theory, i.e. reflecting the hypotheses shown in Table 17, is imposed. In doing so, through tests of statistical significance and criteria for model fit, the theory behind the hypotheses is tested empirically. Figure 4 shows a structural path diagram of the resulting SEM. In the figure, latent variables are shown in ovals while observed variables are represented by rectangles. Moreover, the shown path coefficients emerge from estimation of the model standardising all latent variables, but not observed variables. Where standardising all variables would change the estimate's value, these are provided next to the unstandardised value in green colour. In this way, coefficients are comparable in size since they are empirically scaled such that a unit change in the variables measures one standard deviation of the variable in the sample. On the other hand, standardising some variables is not necessarily desirable when their physical meaning is better articulated by their original scale. In some cases it is even conceptually meaningless to do so, like with the binary FEM variable, where interpreting path coefficients once standardised becomes an incoherent task. For this reason both sets of estimates are depicted.

In terms of model fit, similar to CFA, all incremental (CFI=0.979; TLI=0.980) and absolute (RMSEA=0.052; SRMR=0.057) indices that were considered indicate good fit. The normed chi-square (chi-square to degrees of freedom ratio) is 1.8:1, well below the typical threshold of 3:1 (or less) which is argued to indicate good fit (Hair Jr et al., 2010). Figure 4 also reports the coefficients of determination (or R^2) for each variable explained by the model. The model does particularly well in explaining the variance in psychological distance (21% variance explained) and intentions constructs (50%, 39% and 18% variance explained in order of decreasing abstraction). In the case

of dispositions toward sustainable consumption, the predictor included in the model – gender - only explains about 4% of the variance. This is to be expected since there is a lot more going on behind dispositions than gender, and the model treats it as a quasi-exogenous variable. In other words, it is not the goal of the model to explain the variance in dispositions toward sustainable consumption, but rather to explain other mechanisms given certain dispositions.

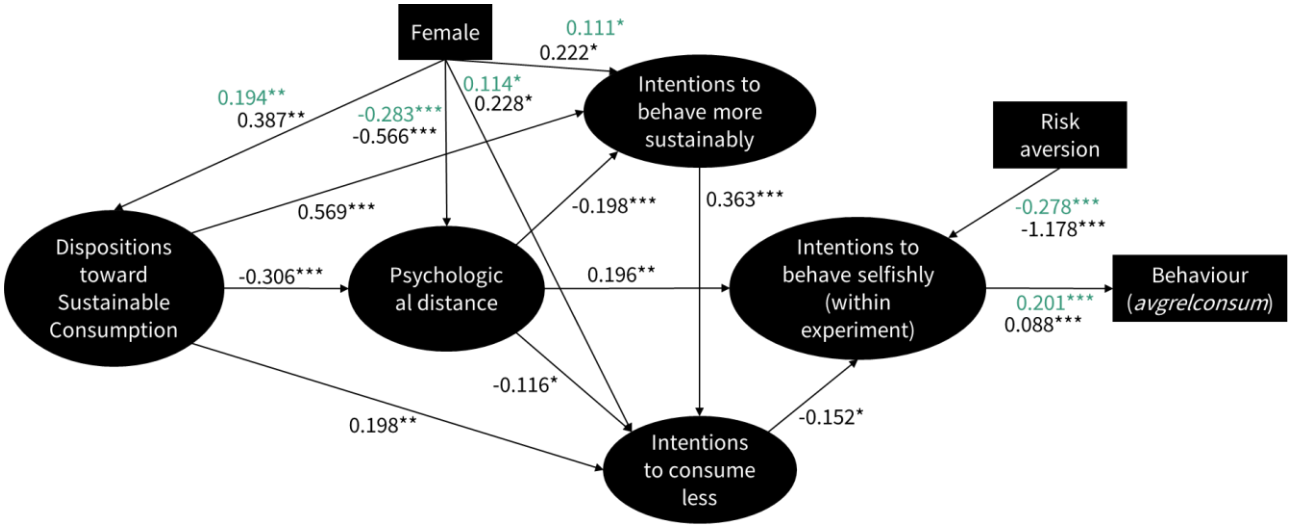


Figure 4. Structural model of sustainable consumer behaviour (scaled chi-square= 388.759[p=0.000], d.f.=218, RMSEA=0.052; SRMR=0.057; CFI=0.979; TLI=0.980). The "Behaviour" variable is consumption level relative to others averaged over time. Label: *p<0.05; **p<0.01; ***p<0.001. The coefficients of determination (R^2) for each structural regression in the model are: R^2(Dispositions toward sustainable consumption)=0.04; R^2(Psychological distance)=0.21; R^2(Intentions to behave more sustainably)=0.50; R^2(Intentions to consume less)=0.39; R^2(Intentions to behave selfishly)=0.18; R^2(Behaviour)= 0.04.

Finally, the predictors included in the model are only able to explain about 4% of the variance in the behavioural variable. Note that the model explains greater proportions of the variance in intentions the more abstract they are, with intentions to behave selfishly in the experiment having 18% of its variance explained. The extrapolation of this, and the expectation that can be drawn from abstraction bias directly, is that the proportion of variance that is explained by such a model, built around the intentions-behaviour relationship, in actual behaviour will be even lower, i.e. the intentions-behaviour gap. Therefore, the low R^2 value for the behavioural outcome that the model exhibits is not only not a sign of lack of validity, but a sign of realism. The conclusion that can be drawn from this is that once actual behaviour (not self-reported) is being examined, most of the variance occurs for reasons other than the formation of intentions.

Before turning to discussing the hypotheses against the model, some of the mediation effects are considered in order to calculate total effects between pairs of dependent-independent variables (Baron and Kenny, 1986; Preacher, Rucker and Hayes, 2007; Hayes, 2009). For illustrative purposes, consider the effect of risk aversion on behaviour. This does not take place directly, but instead through the former's effect on intentions to behave selfishly within the experiment, which in turn affects behaviour, i.e. intentions to behave selfishly within the experiment mediates the effect of risk aversion on behaviour. The indirect effect, taking place through the mediator, can be computed by multiplying together the effects of the explanatory variable (here risk aversion) on the mediator (here intentions to behave selfishly within the experiment), and that of the mediator on the outcome variable (behaviour, in this case) (Baron and Kenny, 1986). Then the total effect of the explanatory on the explained variable is the sum of the indirect and direct effects (the latter of which in this example is zero) (Preacher, Rucker and Hayes, 2007; Hayes, 2009). The general algorithm is to separate effects into indirect and direct, i.e. effects that go through other variables, and effects that happen directly from the independent to the dependent variable (Hayes, 2009). When more complex mediation structures arise, one or more chains of causal links between the explanatory and outcome variable arise. Each chain from the independent to the dependent variables represents what is known as a *specific indirect effect* (Preacher, Rucker and Hayes, 2007; Hayes, 2009). As such, a specific indirect effect exists for each unique chain that can be drawn from the independent to the dependent variable. The sum of all specific indirect effects is called the total indirect effect, and adding the latter to the direct effect is the total effect (Hayes, 2009).

Total effects were computed for all variables, on all the other variables they explain in the model, ultimately leading to the effects of all variables on behaviour. The results are presented in Table 18. Here, one column refers to the explanatory variable of interest, labelled 'Explanatory'; one refers to the explained variable of interest, labelled 'Explained'; the next group of three columns, 'WLSMV' provides estimates of total effects obtained when the model treats item variables as ordinal explicitly, using the WLSMV estimator. Within this group, estimates are provided for all unstandardised variables (Est.), when only standardising latent variables (L. std.), and when all variables in the structural model are standardised (All std.). The next, 'MLM' provides estimates of total effects obtained when the model treats item variables as continuous, using the MLM estimator, when all variables are standardised. The statistical significance of these is noted through the following key: * $p < 0.05$, ** $p < 0.01$, ***$p < 0.001$. This seeks to optimise comparability (1) of estimates between estimators, (2) effect sizes within MLM estimation (hence all

standardised), and (3) of significance implied by each estimation method (i.e. standard errors). The 'Std. Err.' column shows standard errors for the estimates obtained trough WLSMV. Finally, the last column provides the p-values used to establish statistical significance of the effects when WLSMV was applied. All the effects were computed as parameters in the model and therefore confidence intervals, and p-values, were computed directly from the model. In the following section the results are discussed in relation to the hypotheses developed in the conceptual framework (Chapter 3), which are summarised in Table 17.

Explanatory	**Explained**	**WLSMV**			***MLM***	**Std. Err.**	**p-value (WLSMV)**
		Est.	**L. std.**	**All std.**			
Dispositions toward sustainable consumption (DSC)	BISUST	0.715	0.629	0.629	*0.627****	0.041	**0.000**
	BIRED	0.532	0.462	0.462	*0.472****	0.052	**0.000**
	INT	-0.116	-0.130	-0.130	*-0.120***	0.032	**0.000**
	Behaviour	-0.014	-0.011	-0.026	*-0.025**	0.005	**0.011**
Intentions to consume more sustainably (BISUST)	BIRED	0.368	0.363	0.363	*0.285***	0.062	**0.000**
	INT	-0.043	-0.055	-0.055	*-0.040*	0.022	0.050
	Behaviour	-0.005	-0.005	-0.011	*-0.008*	0.003	0.087
Intentions to consume less (BIRED)	Behaviour	-0.014	-0.013	-0.030	*-0.029*	0.007	0.061
Psychological distance (PD)	BISUST	-0.216	-0.198	-0.198	*-0.153**	0.057	**0.000**
	BIRED	-0.208	-0.188	-0.188	*-0.160**	0.065	**0.001**
	INT	0.193	0.225	0.225	*0.204***	0.054	**0.000**
	Behaviour	0.023	0.020	0.045	*0.042**	0.009	**0.012**
Female (FEM)	DSC	0.321	0.387	0.194	*0.230****	0.103	**0.002**
	PD	-0.589	-0.685	-0.343	*-0.348****	0.109	**0.000**
	BISUST	0.543	0.578	0.289	*0.311****	0.121	**0.000**
	BIRED	0.567	0.594	0.297	*0.290****	0.118	**0.000**
	INT	-0.165	-0.225	-0.112	*-0.104***	0.044	**0.000**
	Behaviour	-0.020	-0.020	-0.023	*-0.021**	0.008	**0.010**
Risk aversion (RA)	INT	-0.868	-1.178	-0.278	*-0.285****	0.209	**0.000**
	Behaviour	-0.103	-0.103	-0.056	*-0.059**	0.039	**0.008**
Intentions to behave selfishly in the experiment (INT)	Behaviour	0.119	0.088	0.201	*0.206***	0.034	**0.000**

Table 18. Total effects (mediation) analysis amongst variables in the structural equation model (SEM). Columns are as follows: 'Explanatory' – The variable from which the total effect originates. 'Explained' – The outcome variable that is influenced by the total effect. 'WLSMV' – Total effect estimates calculated treating items as ordinal, using the WLSMV estimator ('Est.' – unstandardised variables; L. std. – latent variables standardised only; All std. – all variables standardised). 'MLM' – Total effect estimates obtained treating items as continuous, using the MLM estimator and with all variables standardised (* $p < 0.05$, ** $p < 0.01$, ***$p < 0.001$). 'Std. Err.' – Standard error of estimates from WLSMV estimation. 'p-value (WLSMV)' – Statistical significance of the total effect estimate from WLSMV estimation. Variables are: DSC – Dispositions toward sustainable consumption. BISUST – Intentions to behave more sustainably (external to experiment). BIRED – Intentions to consume less (external to experiment). PD – Psychological distance to climate change. FEM – Gender (1=female; 0=male). RA – Risk aversion. INT – Intentions to behave in a self-profit maximising manner (internal to experiment). Behaviour – Consumption level relative to others averaged over time (i.e. *avgrelconsum*, **introduced in Section 4.4.5**).

5.4 Results and hypotheses

As will be discussed below in more detail, the vast majority of hypotheses were supported by the model, while the remaining ones were at least partially supported to a high degree. Prior to introducing this discussion, it is worth noting that behaviour in the model is operationalised in terms of peoples' consumption from the resource (relative to members of their group, and averaged over time). Therefore, reductions in this variable, 'Behaviour' in Figure 4 and Table 18, represent increments in sustainable consumer behaviour (SCB) rather than the opposite. A similar case is made for intentions to behave selfishly within the experiment, which represents intentions to behave in a self-profit maximising manner (internal to experiment), therefore lower scores imply greater intentions to behave with collective well-being in mind, i.e. sustainably.

While all hypotheses were supported, the extent to which they were and additional discussion points were made possible by the results of the analysis, all of which are offered in the following sections.

5.4.1 Abstraction bias in the relationship between intentions and actual behaviour

Hypotheses 1, **1a**, **2** and **2a** were developed to explore the degree to which abstraction bias plays an important role in the intentions-behaviour coherence, or lack thereof. A central role is played conceptually in this analysis by the abstraction of framing of intentions in their operationalisation. As explained in Chapter 3 (Sections 3.2.2 and 3.4.2), this builds on some important behavioural implications of construal level theory and ideas from the concept of implementation intentions. Construal level theory has been used to explain the intentions-behaviour gap theoretically by relying on the idea that abstract representations of behaviours

highlight overarching goals and values, i.e. abstract attributes. Fundamentally, intentions and attitudes are more abstract than any actual behavioural setting by virtue of their hypotheticality. The term abstraction bias has been coined in this Thesis to refer to a generalised version of construal level theory's claims. Inspired by the concept of implementation intentions, it was argued that abstract-concrete is not just a qualitative dichotomy, instead it bears quantifiable elements based on degree of abstraction.

This conceptualisation was supported by the structural model which manifested the hypothesised positive mediation, by concrete intentions, of the effect of more abstract intentions on actual behaviour. Effectively this crates a chain from the most abstract intentions to behave more sustainably (BISUST) to behaviour, going through intentions to consume less (BIRED), and intentions to behave selfishly in the experiment (INT) last (see Figure 4); where all effects exhibit the expected sign and are statistically significant. These results support **Hypotheses 1** and **1a** directly.

The results show that total effects of the more abstract BISUST and BIRED on behaviour were non-significant (and non-negative). Concrete intentions, intentions to behave selfishly within the experiment, were the only significant intentions construct with a significant, and positive effect on behaviour (see Figure 4 and Table 18). That is, people claiming to intend to maximise self profit were significantly more likely to consume more, as expected. Therefore, **Hypotheses 2** and **2a** are also supported by the model.

5.4.2 Psychological distance as a mediator in the dispositions-intentions relationship: Testing abstraction bias in the intentions-behaviour gap

Hypotheses 7, 7a and 7b were developed to assess the mediating role of psychological distance in the relationship between dispositions toward sustainable consumption and intentions constructs. To complete the picture, **Hypotheses 3, 4, 5, 5a and 6** relate the hypothesised mediating role of psychological distance to abstraction bias, hence creating different expectations for intentions of varying abstraction. The results are discussed relative to these hypotheses (summarised in Table 17) below.

The mediating role of psychological distance to climate change in the dispositions toward sustainable consumption-intentions relationships was confirmed by the model (Figure 4 and Table 18). This corresponds to **Hypotheses 7, 7a and 7b**, suggesting that dispositions toward sustainable consumption operate partly by reducing psychological distance (**Hypothesis 7b**),

which in turn positively affects the formation of intentions (**Hypothesis 7a**). In particular, while dispositions toward sustainable consumption relate to all framings of intentions, when they are more concrete this relies more strongly on a reduction in psychological distance, which can bridge the usual gap between general and concrete representations of behaviour. Within this framework, the effect of psychological distance was found to be significantly more salient for the most concrete intentions, i.e. intentions to behave selfishly within the experiment, as proposed in **Hypothesis 3**. On the other hand, between BISUST and BIRED, the effect of psychological distance on the former is slightly larger than on the latter. However, it is less than a standard error (on either estimate) difference, therefore, they can be considered essentially equal. Moreover, MLM estimation does reproduce the expectation of **Hypothesis 3** for all intentions constructs, but again between BISUST and BIRED the difference is almost negligible. This can be explained by BISUST and BIRED being more closely related to one another than to intentions to behave selfishly within the experiment, such that these factors are les susceptible to the hypothesised differences. Such a feature is actually evidenced by discriminant validity checks (Section 5.2.5), which showed that BISUST and BIRED correlate much higher between each other than either does with intentions to behave selfishly within the experiment. On these grounds, the model is considered to support **Hypothesis 3** to a great extent, and the results provide no grounds on which to reject the hypothesis.

Moreover, a positive total effect of dispositions toward sustainable consumption on all intentions was identified, which was stronger the more abstract their framing, hence supporting **Hypotheses 5 and 5a**. In relation to the previous discussion on how the psychological distance-intentions relationships vary in strength due to abstraction, the difference in size of the dispositions toward sustainable consumption-intentions effects were more salient. However, they still are in coherence with the difference between BISUST and BIRED being smaller than that between either and intentions to behave selfishly within the experiment. This suggests that, while the effect of dispositions toward sustainable consumption on intentions is very dependent on abstraction level, the effect of psychological distance is more stable. Therefore, reducing psychological distance is limited in its capacity to counteract abstraction bias in instances where it is very salient.

In terms of the effects of either dispositions toward sustainable consumption and psychological distance on actual behaviour, both of these were significant and of the expected sign (**Hypotheses 4 and 6**). A negative total effect of psychological distance on sustainable

consumer behaviour (SCB) was identified, since psychological distance was found to relate to increased consumption in the model (i.e. less SCB). On the other hand, dispositions toward sustainable consumption relates positively to SCB since a significant effect was found on reducing the levels consumed. Moreover, it is worth noting that the effect of psychological distance on actual behaviour was significantly stronger than that of dispositions toward sustainable consumption, which is in line with abstraction bias – dispositions toward sustainable consumption relate more closely to values and hence abstract representations brought about by intentions, while reduced psychological distance relates to concrete representations which align best with actual behaviour.

5.4.3 Gender and the intentions-behaviour gap

Hypotheses 17, 18, 19, 19a and 20 were developed to test gender effects relative to the intentions-behaviour gap (IBG). According to these, being female, relative to being male, relates to increased dispositions toward sustainable consumption (H17), reduced psychological distance (H18) and greater intentions to consume more sustainably (H19), as well as increased adoption of sustainable consumer behaviour (SCB) (H20). All the hypotheses were confirmed by the model as evidenced by total effects shown in Table 18. Interestingly, gender is found to play a bigger role in reducing psychological distance than in increasing dispositions toward sustainable consumption, when comparing standardised coefficients which are measured in units of 1 standard deviation (Table 18). However, despite the closer connection of psychological distance to more concretely framed intentions, gender still relates more closely to intentions the more abstract their framing as **Hypothesis 19a** posited, evidenced by the total effects shown in Table 18. This may suggest that other unobserved constructs, beyond dispositions toward sustainable consumption, which also bear important gender differences and relate to abstract mental representations, are also playing a part. Some examples of these constructs are values, attitudes, environmental concern, and so on (Stern, Dietz and Kalof, 1993; Zelezny, Chua and Aldrich, 2000; Kollmuss and Agyeman, 2002; Fukukawa, Shafer and Lee, 2007; Dhenge et al., 2022; Yang et al., 2022). The total effect of gender on behaviour predicts reduced consumption levels (i.e. more SCB) for females, relative to males, in line with **Hypothesis 20**. However, the significant relationship between gender and intentions, dispositions toward sustainable consumption and psychological distance does not proportionately translate into actual behaviour, as shown in Table 18 by comparing standardised

effects. This suggests that the IBG may in fact be enlarged for females when compared to males, even if the former still enact more SCB.

5.4.4 Risk aversion and behaviour in a risky world

Hypotheses 21, 22 and 22a were developed to test the effect of risk aversion on sustainable consumer behaviour (SCB) adoption, mediated by concrete intentions, i.e. intentions to behave selfishly within the experiment. In the analysis, risk aversion was found to relate significatively and positively to adoption of SCB through a negative total effect on consumption levels (Table 18). This confirms **Hypothesis 21**. Moreover, it is shown to come into full effect at the stage of intentions formation, provided the role of risk is made explicit in their framing. That is, the effect of risk aversion on SCB is totally positively mediated by concrete intentions in the model. Note that while the effects shown in Table 18 are negative, this corresponds to increased sustainability-oriented intentions, and subsequent SCB, since consuming less corresponds to increased sustainability.

5.5 Conclusions from the structural equation model

A structural model was proposed to explain the role of mental representations of behaviour and framing, by means of the concept of abstraction bias, in the formation of the intentions behaviour gap (IBG). This was done by observing behaviour directly, rather than relying on self-reports, and capturing intentions framed at different levels of abstraction, allowing for comparison. The model plays both a conceptual and methodological role as it incorporates elements of perception to differentiate constructs, i.e. framing. The operationalisation of latent variables is first assessed for all the customary psychometric checks: unidimensionality, convergent discriminant and nomological validity, which are satisfactorily met. The scales were then used in combination with other observed variables to build a structural model inspired by the hypotheses developed in Chapter 3 (summarised in Table 17). The model presents good fit to the data and empirically supports the all the hypotheses, uncovering important unprecedented processes that lie behind the IBG in sustainable consumer behaviour (SCB). It is worth noting that given the high rate of acceptance of the hypotheses that had been posed, nomological validity of the scales used was further supported by the structural equation modelling (SEM) stage of the analysis.

The model did not account for institutional setting explicitly, which was made implicit in the operationalisation of sustainable consumer behaviour (SCB). In other words, these results can

be thought to correspond to a constant setting that does not change between individuals. This increases comparability with extant empirical research that explores the intentions-behaviour relationship using SEM analyses without accounting for setting (i.e. setting is accounted for by creating homogeneity at sampling). In the following chapter, institutional setting is accounted for, in order to explore its role and significance relative to SCB and the psychological processes described in this chapter.

CHAPTER 6: ANALYSIS AND RESULTS II

6.1 Introduction

The previous chapter reported a structural equation model testing part of the hypotheses developed in Chapter 3. The analysis reported in this chapter seeks to contribute to addressing the hypotheses developed in Chapter 4 and providing further discussion on already tested hypotheses (Chapter 5) through an alternative analytical perspective.

#	Hypotheses
H2	More concretely framed intentions have a stronger total effect on actual behaviour than more abstract framings.
H2a	The total effect of any framing of intentions on actual behaviour is non-negative. In other words, it is either positive or non-significant (i.e. not sufficiently different from zero).
H4	The total effect of psychological distance to climate change on actual behaviour is negative.
H6	The total effect of dispositions toward sustainable consumption on actual behaviour is non-negative.
H8	Better information quality positively influences adoption of sustainable behaviour.
H9	The effect of resource size on adoption of sustainable behaviour depends on whether it is considered abundant or scarce.
H9a	Resource abundance negatively influences adoption of sustainable behaviour.
H9b	Resource scarcity positively influences adoption of sustainable behaviour.
H10	Collective consumption levels positively influence individual consumption levels within the group.
H11	Others' consumption level negatively influences individuals' consumption levels.
H12	Others' consumption level negatively influences individuals' consumption levels more for individuals with greater dispositions toward sustainable consumption, relative to lower scoring ones.
H13	Others' consumption level negatively influences individuals' consumption levels more for individuals that are less psychologically distant from climate change, relative to more distant ones.
H14	The effect of intentions on the formation of behavioural outcomes is sensitive to changes in institutional setting.
H15	The effects of psychological and demographic factors on behaviour are significantly sensitive to changes in institutional setting.

#	Hypotheses
H16	Failure to account for institutional setting results in the overestimation of the significance of the effect of psychological and demographic variables on sustainable behaviour.
H20	The total effect of being female on SCB, relative to being male, is positive.
H21	Risk aversion positively influences sustainable consumer behaviour.

Table 19. Summary table of hypotheses, relevant to Chapter 6's analysis. All hypotheses shown in black (8-16) were introduced and explained in detail in Chapter 4 (Section 4.4.6). The rest (shown in green) were developed in Chapter 3, and were already accepted by means of structural equation modelling (SEM) analysis in Chapter 5. These are now further discussed in the context of accounting for institutional setting dynamics.

The analysis conducted in Chapter 5 using a structural equation model (SEM) has the benefits of offering rigorous measurement of latent factors and modelling of a complex structure of causal links all at once. The analysis presented in this research benefits from these by extracting factors from the confirmatory factor analysis (CFA) model (Chapter 5). As discussed in Chapter 4 (Section 4.4.6, p. 113), the elements of institutional setting that are observed in this research are designed into the experimental design: resource size, uncertainty treatment (risk and ambiguity) and others' consumption. The analysis conducted in this chapter accounts explicitly for the dynamics of behaviour in the experiment from one round to the next, and how it is influenced by institutional setting, through a linear mixed effects model. This offers a good framework for assessing the remaining hypotheses, which pertain primarily to the role of institutional setting and its interactions with idiosyncratic factors of individuals. That is, in addition to further assessing relevant hypotheses that were already discussed in the context of SEM in Chapter 5. All the hypotheses applicable to this chapter are summarised in Table 19.

This chapter is structured as follows: Section 6.2 begins with an overview of the empirical framework, which introduces the variables used, descriptive statistics and the formulation of the model. Next, in Section 6.3 the mixed effects model fitted to the data is presented, and in the results are discussed with a focus on the hypotheses shown in Table 19.

6.2 Empirical framework

A mixed effects model, with random intercepts and fixed slopes, was developed to explain individual consumption level as a function of psychological, demographic and institutional setting variables in line with the conceptual framework developed in Chapter 3, and the hypotheses developed in Chapter 4, summarised in Table 19.

Behavioural intentions lie at the centre of the structural model fitted in Chapter 5. The model confirmed the more concrete the framing of intentions, the stronger its significance in explaining actual behaviour. This was hypothesised using one of the main behavioural implications of CLT, abstraction bias. Thereby, abstract framings of behaviours evoke abstract mental representations, based on values and goals, drawing attention away from the practical issues associated with actually enacting the behaviour (Section 3.2.2). Moreover, dispositions toward sustainable consumption (DSC), psychological distance (PD) to climate change, risk aversion (RA) and gender (FEM) were hypothesised to play an important role in the formation of intentions leading to subsequent behaviour (see Figure 4, p. 146). The relevant hypotheses were confirmed by the analysis (see Chapter 5). The present analysis has nothing to add relative to how these constructs interact with one another. Instead, the focus lies on their (total) effects on actual sustainable consumer behaviour (SCB), while controlling for the dynamics and effects of elements of institutional setting.

The structural equation modelling (SEM) results suggested all constructs have significant total effects on SCB, except for abstractly framed intentions which were external to the experimental context, BISUST (intentions to consume more sustainably) and BIRED (intentions to consume less) (Section 4.4.4). These were still included in the present analysis since intentions play a central role in intentions-behaviour gap (IBG), and as further test of the hypotheses. Therefore, the three framings of varying concreteness used in the previous analysis, INT (intentions to behave such as to maximise self-profit in the experiment), BIRED and BISUST (in order increasing abstraction) are also included in this analysis. However, the BISUST factor was highly non-significant which led to its exclusion from the model. Other variables from the SEM analysis, dispositions toward sustainable consumption, psychological distance, risk aversion and FEM are also considered. The use of the same constructs solidifies the present analysis as complementary to the SEM analysis carried out in Chapter 5, by enhancing comparability of the results. The section that follows offers a closer look at the variables included in the model.

6.2.1 Variables

In this section, the variables used in the model are explained. The methodology chapter (Chapter 4) offers a more in-depth look at the choice of operationalisation for each construct. The variable names are listed in Table 20, together with a short description for each. Throughout this chapter, t, i, and j index periods, individuals, and groups, respectively. Where a variable changes at one

level only, the indices corresponding to the other two are omitted. For example, $treatment_j$ varies between groups but not individuals nor periods. Variables like $consum_{t,i,j,}$, vary between groups in addition to between and within individuals.

Variable	Description
$treatment_j$	Known vs. unknown probability of an Armageddon event (1-known, 0-unknown)
$period_t$	Period or round. This is the *time* variable.
INT_i	Behavioural intentions concrete to the experimental setting
$BISUST_i$	Intentions to consume more sustainably (external to the experiment)
$BIRED_i$	Intentions to consume less (external to the experiment)
DSC_i	Dispositions towards Sustainable Consumption
PD_i	Psychological distance to climate change
ra_i	Risk aversion
fem_i	Gender (1-female, 0-male)
age_c_i	Categorical age variable (discretised using k-means)
cpr_{tj}	Resource size at the beginning of the period.
$others_{(t-1)ij}$	Consumption of others in individual i's group, at time $t-1$ (i.e. the previous round). $:= \sum_{a \neq i} consum_{(t-1)aj}$.
$consum_{tij}$	Individual i's consumption at time t.

Table 20. Summary of variables used in the mixed effects model described in this chapter. Indexing integers $\boldsymbol{t}$, $\boldsymbol{i}$, and $\boldsymbol{j}$ refer to the period, individual, and group, respectively. Indices shown depict the level at which the variable varies. Levels in which the variable remains constant are dropped.

Latent factors for dispositions toward sustainable consumption, psychological distance, BIRED and intentions to behave selfishly within the experiment were predicted from the CFA model reported in Chapter 5 (Table 13, p. 134). Risk aversion was measured as the average of the four probabilities associated with the four lotteries in the SGG risk elicitation task (Table 10, Section 4.4.3, p. 106). Gender is a binary variable coded as 1 for female and 0 for male. In sum, psychological and demographic factors employed the same operationalisation as in the structural equation modelling (SEM) analysis presented in Chapter 5. This increases comparability of the results from both analyses.

Additionally, several elements of institutional setting were observed, based on the conceptualisation typical of experimental economics (Ostrom, 2002). Resource size at a given time was measured as the starting size for that round, i.e. after resource regeneration from the previous round (e.g. van Klingeren, 2020). It is operationalised as a percentage of the original

resource size. The treatment variable captures quality of information, it is a binary variable coded as 1 for risk (known probability) and 0 for ambiguity (unknown probability) (e.g. Palm-Forster and Suter, 2022). Treatment varies between, but not within, groups. Others' consumption, in the previous round, was measured as the sum of the tokens consumed by other participants in the same group (e.g. van Klingeren, 2022). A unit increase in this variable corresponds to one more token consumed collectively by others in an individual's group, in the previous round. The variable is lagged one round because individuals cannot react to present consumption, since this is unknown at the time of decision-making.

Finally, the model controls for age, operationalised as a 3-category ordinal variable discretised using k-means clustering of the continuous age variable (with breaks at 18, 22.7, 38.1, and 69 years), to offer better interpretability and potential non-linear relationships (Jain and Dubes, 1988; Muhlenbach and Rakotomalala, 2005). Period number is included as a time variable, accounting for time variation in consumption that can otherwise confound the effects of other time-varying variables, like much of institutional setting (van Klingeren, 2020; van Klingeren, 2022).

6.2.2 Descriptive statistics and general behaviour in the experiment

This section provides descriptive statistics of the variables used on analysis. Descriptive statistics for other variables that offer insight into the behaviours and experimental dynamics observed are also discussed. Table 21 provides all the relevant descriptive statistics and forms the basis for the following descriptive discussion of what was observed. The variable names are provided using their mathematical formulation to show their level(s) of variation. The latter are also shown in the rightmost columns where "B" refers to the level where between-variation is present, and "W" refers to the within-variation levels. For each variable, whether the descriptives relate to the whole sample, or to each treatment separately, is indicated ("Tr."). The number of observations associated, which can change as the level of variation also changes, is provided ("Obs."). Mean and standard errors for the mean ("S.E.") are provided, as well as standard deviation ("S.D."). The 10% trimmed mean ("Trim.") is provided as a measure of central tendency, followed by the minima and maxima for each variable. Skewness and kurtosis are also shown which are used to discuss data normality.

Variable	Tr.	Obs.	Mean	S.D.	Trim.	Min.	Max.	Skew.	Kurt.	S.E.	B	W
$period\_end_j$	All	74	23.03	4.96	22.55	15	39	1.01	1.27	0.58	i, j	t
	1	37	23.86	5.57	23.26	16	39	0.96	0.71	0.92		
	0	37	22.19	4.18	21.9	15	34	0.66	0.33	0.69		
$consum_{tij}$	All	6792	9.62	4.79	9.47	1	18	0.28	-0.94	0.06	t,i,j	
	1	3532	9.09	4.93	8.84	1	18	0.45	-0.91	0.08		
	0	3260	10.2	4.56	10.12	1	18	0.12	-0.84	0.08		
$others_{tij}$	All	6792	28.78	10.2	28.53	5	54	0.16	-0.8	0.12	t,i,j	
cpr_{tj}	All	1704	82.70	13.25	83.99	34.08	100	-0.81	0.27	0.32	t,j	i
	1	883	83.77	13.32	85.35	35.31	100	-1	0.87	0.45		
	0	821	81.55	13.08	82.53	34.08	100	-0.61	-0.26	0.46		
cpr_end_j	All	74	68.42	14.94	68.79	34.08	100	-0.19	-0.35	1.74	j	t
$\overline{cpr}_j$	All	74	82.26	7.58	82.31	65.80	100	-0.05	-0.3	0.88	j	t
	1	37	83.08	8.25	83.10	65.80	100	-0.18	-0.28	1.36		
	0	37	81.43	6.85	81.43	65.84	94.79	0.02	-0.71	1.13		
fem_i	All	295	0.52	0.5	1	0	1	-0.09	-2	0.03	i	t,j
	1	148	0.53	0.5	0.53	0	1	-0.11	-2	0.04		
	0	147	0.52	0.5	0.52	0	1	-0.07	-2.01	0.04		
fem_count_j	All	74	2.08	0.86	2.1	0	4	-0.15	-0.43	0.1	j	t
	1	37	2.11	0.77	2.1	1	4	0.17	-0.65	0.13		
	0	37	2.05	0.94	2.1	0	4	-0.3	-0.61	0.15		
age_i	All	295	22.15	4.71	21.47	18	69	4.75	36.81	0.27	i	t,j
	1	148	22.41	5.65	21.57	18	69	4.91	33.02	0.46		
	0	147	21.88	3.52	21.39	18	41	2.04	6.55	0.29		
age_c_i	All	295	1.34	0.5	1.28	1	3	1	-0.3	0.03	i	t,j
ra_i	All	295	0.55	0.24	0.55	0.1	1	-0.06	-0.64	0.01	i	t,j
$\overline{ra}_j$	All	74	0.55	0.12	0.55	0.26	0.83	-0.17	-0.49	0.01	j	t,j
INT_i	All	295	-0.1	1.21	0.01	-6.03	2.51	-2.37	9.66	0.07	i	t,j
$BIRED_i$	All	295	0.19	1.41	0.04	-4.63	4.58	0.82	1.55	0.08	i	t,j
DSC_i	All	295	0.05	1.14	0.01	-6.59	5.39	0.89	9.76	0.07	i	t,j
PD_i	All	295	-0.28	1.58	-0.07	-4.99	5.1	-0.97	2.11	0.09	i	t,j

Table 21. Descriptive statistics for the experimental variables.

In Table 21, $period\_end_j$, refers to the period number when the game ended for a given group. As shown, groups on average engaged in 23 rounds before an Armageddon event took place or the final (paying) round was reached. The means per treatment, rounded to the nearest whole number, are 24 for risk and 22 for ambiguity. Moreover, the minima and maxima vary per treatment, with $period\_end_j \in [16, 39]$ when in the ambiguity treatment and $period\_end_j \in [15, 34]$ when considering the ambiguity treatment. These observations offer an early indication of the treatment effect. While an Armageddon event ultimately takes place randomly, how likely it is to happen does depend on consumption. Therefore, lasting less periods on average could be an indication that this was indeed more likely, which would explain why it happens sooner.

The mean individual consumption, $consum_{tij}$ in Table 21, was 9 tokens (rounded to the nearest whole number). However, in support of earlier discussed explanations for groups in the ambiguity treatment dying off sooner, the mean was 9 for the risk and 10 for the ambiguity treatments. These may be early indications of the treatment effect. The sum of others' consumption, $others_{tij}$, averaged at 29 (rounded to the nearest integer), which implies two other participants consumed 10 and one 9 (the most equal split possible assuming integer tokens). Moreover, the minimum of $others_{tij}$ was 5, while the minimum individual extraction was 1 (corresponding to a theoretical minimum for this variable of 3). Therefore, for every participant in a group, among other members there was at least one consuming more than 2, or more than one consuming more than one.

The average resource size (cpr_{tj}) over the whole experiment was 82.7% of the resource's original size. The mean was higher for the risk (83.8%) than for the ambiguity (81.6%) treatments, again pointing towards a potential treatment effect. In Table 21, cpr_end_j is the size of the resource at the last period for each group. The average resource size at the last round between groups was 68.4%, while the smallest size the resource ever got across all groups is 34.1%. This is also the case across all periods, not only final ones, as evidenced by the minimum cpr_{tj} value. Finally, the average of within group mean resource sizes is 82.3%. However, when only the risk treatment is considered the mean is 83.1%, while it is 81.4% for the ambiguity treatment. This once again shows early signs of a potentially significant treatment effect.

In terms of gender, both treatments had comparable representation from both genders, 53% in the risk, and 52% in the ambiguity treatments, were females. This results in equal representation over the whole sample too, where 53% of participants were female. The variable fem_count_j counts the number of females in a group, and hence the gender composition of groups. On average, groups over both treatments regardless of whether they are taken together or separately, contained 2 females. It is worth noting that while all-female groups (of 4) emerged in both treatments, the risk treatment contained no all-male groups, with the minimum of females in any group in this treatment being 1. This is no cause for concern since interactions between treatment and gender composition is not of interest to the present analysis, the modelling techniques employed consider effects using all observations together, the treatment variable is explicitly controlled for, and there is enough heterogeneity in gender composition of groups to separate its effects on behaviour.

Regarding age, some outliers are observed since sampling was not restricted based on age. In outlier analysis (Appendix C) it was shown that age did not predict an increased probability of being an univariate or multivariate outlier. Therefore, this is considered a feature of randomness in sampling which does not exhibit concerning effects on subsequent analyses. K-clustering was used to discretise this variable into a three category variable to make it more suitable for statistical modelling, Table 21 shows its descriptives for reference.

For risk aversion, ra_i, the mean value was 0.55 meaning that on average individuals chose probabilities above 50% in the lotteries – showing overall signs of risk aversion. Finally, the factors extracted from CFA of Chapter 5, have means close to zero since they were standardised in the CFA model. Some of these variables show some signs of non-normality, the most salient of which are intentions to behave selfishly within the experiment and dispositions toward sustainable consumption's kurtosis, as well as the former's skewness. These are not problematic given that mixed effects modelling expects normality of the residuals and random effects only, and not the variables in the model themselves (Bell, Fairbrother and Jones, 2019; Schielzeth et al., 2020). It is worth noting that even violations of expected normality of residuals and random effects has been shown to only lead to mild bias, which may be less problematic than alternative estimation methods that are less well known like non-parametric methods which have other issues (Bell, Fairbrother and Jones, 2019; Schielzeth et al., 2020; Knief and Forstmeier, 2021). Moreover, the identified deviations from normality are realistic and consistent features of questionnaire instruments about sustainability, climate change and behaving collectively-mindedly, since these are environmental issues that bear controversy due to their heavy political, ethical and ideological load (Buckley, 1999; Hughes, 2009; Le Billon, 2015; Eskjær and Horsbøl, 2023).

The following section describes the average general behaviour that was observed in the experiment in order to provide an initial idea of behavioural dynamics in the experiment.

The Armageddon experiment as a qualitative observation tool for sustainable consumer behaviour (SCB)

While it is not the main goal of this chapter, a broad view into the behaviour that participants exhibited on average, can offer descriptive value. To that end, the between-subjects average extraction over the whole sample was plotted over time, Figure 5 (red line). As shown in Appendix B some benchmark solutions were computed for reference: the Nash equilibrium (pink line in Figure 5) and the collective optimal strategy (blue line in Figure 5), for an expected utility model

characterised by a myopic (underestimating risks, leading to overestimation of immediate returns) view of the AG (see Appendix B for a detailed description of the model and benchmark solutions calculations). The Nash equilibrium and collective optimal strategy values correspond to averages over the whole game, which is equivalent to the assumption that the same extraction is repeated over time (static) and between individuals in the same group (symmetric) [10] (Appendix B). Some more insight into the theoretical modelling reported in detail in Appendix B is provided below.

In the utility model (Appendix B), agents fail to acknowledge the potential long-term consequences of their behaviour. This is modelled as a failure to account for the multiplicative nature of joint probabilities, leading to a significant overestimation of the probability of surviving until the final round and collecting the contents of their private funds, hence "myopic". Assuming a maximisation of collective profit, the resulting collective optimal strategy is well above the sustainable threshold of 5 tokens (shown in green in Figure 5), namely 11 tokens. Assuming a maximisation of self-interest yields a Nash equilibrium that nears the maximum possible extraction, namely 17 tokens. Therefore, it correctly characterises the commons dilemma faced by players. The purpose of this model here is descriptive, as explained previously, and is not expected to characterise all behaviour observed in the experiment. Rather, it offers a point of comparison for interpreting the average behaviour that was observed. It does however lead to an important fundamental conclusion, that behaving cooperatively or pro-socially does not necessarily imply a sustainable use of the resource. The way in which the decision process is conceptualised by individuals, like the myopic individual whose decision making is governed by the model presented in Appendix B, can distort one's understanding of their externalities. In the same way that the myopic consumer is unsustainable even when aiming to maximise collective good, other framings of the decision of interest can have the same effect. This is particularly true when a probabilistic end is involved and the situation is complex.

[10] Being static refers to the assumption that the same extraction is repeated over time. Being symmetric refers to the feature that all group participants extract the same amount, governed by the same strategy. These assumptions allow to simplify the model and calculate a numerical value which provides a basis for the benchmark solutions. Moreover, these values can be understood as group- and time- averaged extractions, which aids their interpretation.

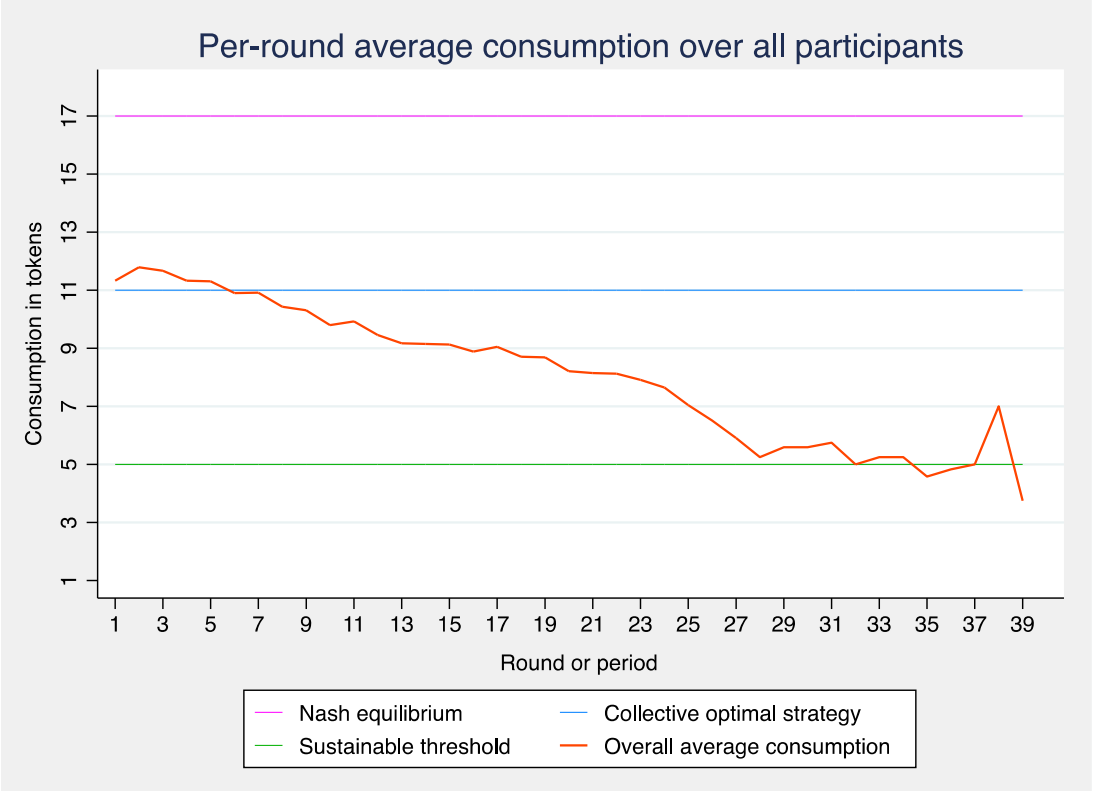


Figure 5. Between-subjects mean extraction over time. The graph shows the mean extraction (shown in red) vary over time as discrete periods. Also shown, are benchmark solutions, namely the static-symmetric Nash equilibrium (pink line) and collective optimal strategy (blue line), for an expected utility model characterised by a myopic (underestimating future consequences, leading to overestimation of immediate returns) view of the AG (see Appendix B for a detailed description of the model and benchmark solutions calculations). The sustainable threshold is also shown (green line). When the between-subjects mean extraction within a group in a given period exceeds this threshold, the resource is be unable to recover to its size at the start of that same period, and is therefore unsustainable.

Assuming the position of a myopic decision-maker, the between-subjects mean extraction (red line, Figure 5) can be considered cooperative from the offset. It revolves around 11 tokens (blue line in Figure 5) for the first 7 to 9 rounds. These extraction levels are far from sustainable and almost certain to bring about an Armageddon event if sustained. A decrease in average extraction can be observed between periods 7 and 24, from around 11 tokens to 8 tokens. Then, from periods 24 to 28 a steeper fall characterises the average extraction, namely from 8 tokens to about 5 tokens (i.e. the sustainable threshold). Finally, the average extraction line can be seen to revolve around the sustainable threshold with some abrupt jumps, affecting the smoothness of the line. Beyond round 25, less than half of the groups remained so the mean was based on less data points, making each group more significant overall. Therefore, as the last rounds are reached, the behaviour of just a few participants is accounted for in the mean. It is not surprising,

therefore, that there is an abrupt drop towards the 5 tokens mark after round 25, since the groups that have survived have managed to do so by behaving somewhat sustainably.

In sum, it is reasonable to interpret that participants on average attempted to behave more sustainably and consume less as the resource was depleted. However, the reaction that can be inferred from Figure 5 is too slow to ensure survival until the final (payment) round. This was also made apparent by the fact that only 3 out of the 74 groups survived until their group's randomly determined final round, meaning they were the only groups who had a non-zero Payment 1. This points towards a significant underestimation of the risks associated with consuming unsustainably, in terms of the average behaviour observed, potentially driven by several factors. Some potential examples are, the shared consequences with participants' future and hypothetical selves, the responsibility and consequences being shared with others in the group, accompanied by a myopic (underestimating future consequences) view of the situation. These are all realistic characteristics of the relationship between micro-level consumption and macro-level sustainability, which were designed into the AG.

6.2.3 Econometric technique

This section offers an account of the rationale for the construction of the model that is subsequently fitted to the data (Section 6.3), and concludes with its mathematical formulation.

Assessing the nested data structure empirically: Is mixed effects modelling supported by the data structure?

Clustering was expected at the group level, and at the subject level within groups, hence addressing the nested (or hierarchical), and not crossed data structure. In other words, groups operate independent from one another, and once a participant was assigned to a group, it did not change. Intra-class correlation (ICC) in the consumption variable when considering clustering within matching groups, and subjects within groups, was 0.53. This was computed by running an intercept only model with random intercepts for groups, and subjects within groups. Then the sum of the variances between groups and subjects was divided by the total variance, which is the former sum plus the residual variance (Gelman and Hill, 2006). This value is very high considering values as low as 0.1 or higher could be taken to suggest a significant grouping structure in the variable of interest (Hair et al, 2010). Musca et al. (2011) explored through simulations the effect of sample size and ICC on the likeliness of Type I error, as a result of modelling techniques that do

not account for a hierarchical data structure. Their results, using 100 Level 2 units, which here corresponds to groups (n=74), and 10 Level 1 units, which corresponds to subjects per group (n=4); show that for an ICC as low as 0.3, corresponds to 39% increase in probability of a Type I error when not accounting for the nested data structure. Given the trend that the simulations show, the reduction in Level 2 units from 100 (in the simulations) to 74 (experiment) is unlikely to influence this probability, while the difference from 10 (simulation) to 4 (experiment) is likely to reduce the problem. However, ICC is clearly the most significant factor and is shown to scale up the problem quickly going from 6.8% at ICC=0.01, to 23.4% at ICC= 0.2, and 39% at ICC=0.3. Therefore, the ICC value of 0.53 that was uncovered, empirically supports the appropriateness of multi-level modelling approaches when taking individual consumption as the outcome of interest.

Unobserved random variance emerges in the data due to repeated observations of the same individuals at different points in time and within several different matching groups which operate independent from one another. Groups have no systematic difference between them (beyond treatment), and participants were pooled using no specific quota beyond equal representation of gender per-treatment. Therefore, the conditions leading to these meaningful differences in consumption between groups, and individuals over time, are in essence random, i.e. they occur beyond the control of the model. Musca et al. (2011) explain how such a research design leads to nested data structures. Additionally, since only two treatments were ran, there are only two types of group, so the treatment effect is more appropriately modelled as a binary predictor (fixed effect) than as a source of randomness between groups (Gelman and Hill, 2006). This is also particularly relevant given the purpose is to make inferences about the treatment effect (Gomes, 2022). Therefore, a mixed model with random intercepts for groups and subjects (within groups), and fixed slopes, is introduced. This decision is further argued below.

Mixed effects: Random intercept and fixed slopes

When modelling random slopes, regression coefficients (i.e. effect sizes or slopes) are allowed to vary randomly in the grouping variables (e.g. groups, and individuals within groups, in this analysis). This is arguably always a more realistic approach relative to not including random slopes (Schielzeth and Forstmeier, 2009; Oberauer, 2022). This is similar to the argument that multilevel models are always better, even when simple linear regression might do a good enough job, again based on realism. These claims are theoretically correct since, in the absence of a

nesting effect on slopes and/or intercepts, these would collapse to simple linear regression estimates (Bell, Fairbrother and Jones, 2019). However, these ideas are in contrast to that of general preference for parsimonious over complex models. Each random slope adds several additional estimated parameters, namely the slope variances and their covariances with the random intercepts, and each other. This significantly decreases degrees of freedom and increases model complexity, which has been shown to increase the probability of Type II errors, and computational requirements (Matuschek et al., 2017; Bell, Fairbrother and Jones, 2019).

Given the large number of variables already included in the model as fixed effects, attempting to fit random slopes quickly becomes computationally intensive as the number of parameters to be estimated escalates geometrically. Therefore, it was necessary to make a choice between effects that shall be modelled as fixed and random ones. However, no theoretical reason was found to expect one variable's effect to vary more randomly, over others', between or within individuals. How individuals might react to others' consumption could vary within-subjects, however this effect will be captured by interaction effects (as will be shown in the following sections), which corresponds to the assumption that these variations are purely due to the psychological profile that can be constructed through the factors that were measured. This may not be strictly realistic since there could be other psychological and demographic factors in effect, but (1) socio-demographic heterogeneity was minimised by a student-dominated sample which increases the chance that these individual differences are in fact due to error, and (2) this view provides a best estimate of the influence of demographic and psychological variables about which the hypotheses were posed (Table 19), hence aiding interpretation in their terms. Any additional variation is considered to be due to random error, and not real unobserved individual differences (Riley, Higgins, and Deeks, 2011). In sum, a model which assumes that any individual variation in the effect of others' behaviour is due to only constructs that are accounted for explicitly (as interaction terms) is a best case scenario in terms of the potential of these demographic and psychological factors to result in observable change, which aids interpretation relative to the hypotheses presented in Table 19.

To provide some additional empirical support for the exclusion of random slopes, the same model reported here was fit but including random slopes for the $treatment$ alone, and for both the former and ra. These choice of these variables was arbitrary for lack of a good theoretical argument. Both cases resulted in estimates that lead to no different conclusions than their random-intercepts-only counterpart. The models in fact demonstrate that the only risk taken

when omitting these specific random slopes, was the slight underestimation of the effects of the associated variables, and their significance. Comparing the models using a LR test, AIC and BIC all supported the intercept-only model over the ones including random slopes. Therefore, on the basis of practicality, parsimony and lack of a good theoretical argument to include them, slopes are modelled as fixed. Random effects were only included for the intercept (mean).

Abundance vs. scarcity

As discussed in the previous section, the resource size is included in the model as one of the elements of institutional setting. Presumably, as the resource is depleted and individuals are conscious of the increased probability of a catastrophe, there is an expectation that they will react by consuming less. However, there is a question of whether this effect is actually linear. In other words, is the effect of the resource size on consumption the same, regardless of its size? It may also be the case that the effect of the size of the resource is conditional on its size. For example, it is not unrealistic to expect that while the resource is abundant, individuals might actually consume more as a result (van Klingeren, 2020; van Klingeren, 2022). Therefore, a turning point can be realistically expected, a level of scarcity beyond which the size of the resource begins to disincentivise individual consumption. Up to that point, the relative perceived abundance could have the opposite, or no effect. This issue is addressed by the introduction of a quadratic term (cpr^2) in the model, which implies the linear dependence of $\frac{\partial(consum)}{\partial(cpr)}$ on cpr. An LR test[11] was used to confirm it improved model fit.

Endogeneity and the random effects assumption

One important assumption implicit in mixed effects models is that the random effects are uncorrelated with the regressors. This is perhaps obvious since once this assumption doesn't hold, they cease to be random, leading to endogeneity. Antonakis, Bastardoz and Rönkkö (2021) point out the prevalence of studies that omit explicit consideration of this assumption. However, it is not always trivial to show that it holds. For example, consider a situation where gender is used as a regressor in a model with a random intercept. It might be the case that gender plays a role

[11] Parameters reported in this chapter were estimated with the restricted maximum likelihood estimator (REML) which is unbiased. LR tests cannot be used to compare nested models, fitted with REML, that only differ in their fixed effects (i.e. the regressors). Therefore, where LR tests were conducted, the equivalent model was fit using regular maximum likelihood (ML), making the test meaningful. AIC and BIC comparisons were conducted normally, on the REML estimated model variants, as they are not subject to the same issue.

not only at the individual level, but also the gender composition of the group could affect its dynamics in significant ways. In this case, not addressing the random effects assumption would result in an unreliable model as the random part would be confounded by gender.

Antonakis, Bastardoz and Rönkkö (2021) discuss and propose the *correlated random effects* approach for testing and explicitly addressing the random effects assumption. This entails generating group-level variables by aggregating individual-level variables and adding them as regressors in the model. Their estimated coefficients are known as *contextual* effects (of the individual-level variable they correspond to). Then, an F test (or Wald χ^2) can be used to test the null hypothesis that all contextual effects are jointly equal to zero. Using this approach led to the inclusion of cluster means for oth_consum and ra, and a group-level variable for fem defined as the sum of all individual fem values in the group. This is just the cluster mean multiplied by a factor of 4, aiding its practical interpretation. Other group means were tested and found to be non-significant, so they were omitted. Appendix G offers a more in-depth account of these tests.

Interactions with institutional setting

Some of the hypotheses to be tested relate to the interaction between psychological and demographic factors and institutional setting (Table 19). One aspect of this involves controlling for both elements in the model, such that confounding effects are avoided. However, interaction terms provide a closer look.

Interaction terms between all psychological and demographic variables, and others' consumption, were tested for significance. As explained previously, this also aims to address potential individual differences in the way others' consumption influences individuals' extractions. F-tests were used, similar to the case described previously for cluster means, to establish joint significance of the interaction terms. Additionally, LR tests, AIC and BIC were used to compare nested models with and without the resulting significant interaction terms. The former addresses local significance of the interaction terms, while model comparisons offer support for the improvement in model fit, or lack thereof, associated to the inclusion of the interaction terms. Based on these tests (see Appendix G), interactions with $others$ are included for fem, INT, DSC, and PD.

Formulating the model

This section addresses the mathematical formulation of the model. Random intercepts for individuals and groups are included. Interaction terms are modelled as fixed effects, in other words random slopes are not included. Cluster means for others' consumption, risk aversion and gender are included to address the random effects assumption. Some notation is developed here to deal with the different kinds of regressors introduced in the model. Estimated effects relating to different types of constructs are assigned different Greek letters as follows: institutional setting - θ, demographics - δ, psychological factors - ψ, interaction terms - η and cluster means - μ. The model is expressed as follows:

$$\begin{aligned} consum_{tij} = {} & \beta_{0ij} + \theta_1 period_t + \theta_2 treatment_j + \theta_3 cpr_{tj} + \theta_4 \left(cpr_{tj}\right)^2 \\ & + \theta_5 others_{(t-1)ij} + \delta_1 fem_i + \delta_2 age_{c_i} + \psi_1 ra_i + \psi_2 INT_i \\ & + \psi_3 BIRED_i + \psi_4 DSC_i + \psi_5 PD_i + \eta_1 \left(others_{(t-1)ij} * fem_i\right) \\ & + \eta_2 \left(others_{(t-1)ij} * INT_i\right) + \eta_3 \left(others_{(t-1)ij} * DSC_i\right) \\ & + \eta_4 \left(others_{(t-1)ij} * PDCC_i\right) + \mu_1 \overline{others}_{(t-1)j} + \mu_2 \overline{ra}_j + 4 * \mu_3 \overline{fem}_j \\ & + e_{tij} \end{aligned} \qquad \text{Eq. (4)}$$

The expression for the intercept is $\beta_{0ij} = \gamma_{000} + v_{00j} + u_{0ij}$. This contains u_{0ij} and v_{00j}, the random intercept for individuals and groups, respectively, and γ_{000} which is the fixed part. All other coefficients are fixed. Cluster means are denoted with a horizontal bar over the corresponding variable's name, e.g. $\overline{others}_{(t-1)j}$. Since $fem\_count_j = 4 * \overline{fem}_j$, the term containing the group gender variable is broken down into its components, to maintain consistency of notation and show that the cluster mean is contained within the fem_count_j variable used to fit the model.

6.3 Results and hypotheses

The results of the linear mixed effects model developed throughout this chapter to the experimental data are shown in Table 22. The table is organised such that it shows the variable name in the leftmost column, followed from left to right by the estimated parameters' mathematical expression, the value for the estimate, standard errors and p-values, in that order. The standard deviation of the group and subject random intercepts, and the residuals, are provided in the bottom section of the table. Using Nakagawa and Schielzeth's (2013) approach, the marginal and conditional coefficients of determination (R-squared) were 0.27 and 0.55,

respectively. These correspond to the proportion of variance explained by the fixed part of the model, and to both the fixed and random parts, respectively. This is reported only for reference, as the issue of computing R-squared values in linear and generalised mixed effects models is a challenging and nuanced one (Nakagawa, Johnson and Schielzeth, 2017) beyond the scope of this analysis.

Variable	Parameter expression	Estimate	Std. Error	p-value
(Intercept)	γ_{000}	5.058***	1.538	**0.001**
$period_t$	θ_1	-0.031***	0.009	**0.001**
cpr_{tj}	θ_3	-0.079*	0.031	**0.011**
${cpr^2}_{tj}$	θ_4	0.001***	0.000	**0.001**
$others_{(t-1)ij}$	θ_5	-0.152***	0.015	**0.000**
$\overline{others}_{(t-1)j}$	μ_1	0.345***	0.016	**0.000**
$others_{(t-1)ij} * fem_i$	η_1	-0.030**	0.011	**0.006**
$others_{(t-1)ij} * INT_i$	η_2	-0.011*	0.005	**0.025**
$others_{(t-1)ij} * DSC_i$	η_3	-0.016**	0.005	**0.001**
$others_{(t-1)ij} * PDCC_i$	η_4	0.009*	0.004	**0.013**
fem_i	δ_1	1.116*	0.464	**0.017**
age_c_i	δ_2	0.269	0.289	0.353
ra_i	ψ_1	-1.447*	0.727	**0.048**
INT_i	ψ_2	0.780***	0.200	**0.000**
$BIRED_i$	ψ_3	-0.378**	0.118	**0.002**
DSC_i	ψ_4	0.995***	0.214	**0.000**
PD_i	ψ_5	-0.413**	0.150	**0.007**
$treatment_j$	θ_2	-0.683*	0.312	**0.032**
$\overline{ra}_j$	μ_2	1.432	1.459	0.330
fem_count_j	μ_3	0.421*	0.197	**0.036**
Random effect (group)	$\sigma(v_{00j})$	0.513		
Random effect (subject)	$\sigma(u_{0ij})$	2.276		
Residual	$\sigma(e_{tij})$	2.938		

Table 22. Linear mixed effects model with random intercepts for matching groups and individuals, on the outcome $consum_{tij}$. Label: * p < 0.05, ** p < 0.01, ***p < 0.001.

The linear mixed model shown in Table 22 (estimated using REML in the nlme package in R; Pinheiro et al., 2023) was constructed to predict $consum_{tij}$ with $treatment_j$, $others_{(t-1)ij}$, cpr_{tj}, ${cpr^2}_{tj}$, fem_i, ra_i, INT_i, $BIRED_i$, DSC_i, PD_i, and controlling for age_{c_i} and $period_t$, as well as, contextual effects of $others_{(t-1)ij}$, fem_i, ra_i (by including cluster means). The model included matching groups (groupID), and individuals (subjectID) within groups, as random effects (with formula in R package nlme: ~1 | groupID/subjectID; Pinheiro et al., 2023). The model's explanatory power related to the fixed effects alone (marginal R2) is 0.27. The model's intercept (γ_{000}),

corresponding to all regressors being equal to zero, is at 5.06 (95% CI [2.04, 8.07], p = 0.001). However, the zero-value is not in the domain of some regressors and consequently not properly interpretable. The variable $others_{(t-1)ij}$ has a minimum value of 5, and $\overline{others}_{(t-1)j}$ of 6 (Table 21). The base value for $period_t$ is in fact 2, for ra_i it is 0.1, and 0.26 for $\overline{ra}_j$, while for age_{c_i} it is 1. Psychological factors INT_i, $BIRED_i$, DSC_i, and PD_i are standardised, so the zero-value corresponds to the mean between individuals, which offers a good conceptual interpretation. The resource may be considered to be full as the base value, i.e. $cpr_{tj} = 100\%$. Therefore, adjusting for these base values and minimum values as described, the consumption expected on average would be $\gamma_{000} + 5\theta_5 + 6\mu_1 + 2\theta_1 + 0.1\psi_1 + 100\theta_3 + 100^2\theta_4 = 8.26$. This expectation corresponds to a male individual in the ambiguity treatment, in an all male group, minimal consumption of others and group consumption, minimal risk aversion, at the first possible experimental period, with full resource abundance, and with sample-mean values for psychological constructs.

Before discussing the effect of each regressor in the model, it is worth mentioning that the more individuals consume, the less sustainable consumer behaviour (SCB) they enact. For this reason, effects are reversed in sign when talking about SCB, but are in line with the conceptualisation of consuming less. Similarly, due to the results of EFA (see Appendix D), concrete intentions (INT_i) are negatively operationalised. In other words, the items that made it to the CFA were decreasing in pro-environmental intentions. Therefore, INT_i is expected to positively relate to the dependent variable. That is to say people who report more intent to behave less pro-environmentally are expected to consume more.

6.3.1 Institutional setting: Treatment effect, others' consumption, and abundance vs. scarcity

Within the model, the effect of treatment is statistically significant and negative (θ_2 = -0.68, 95% CI [-1.31, -0.06], t(70) = -2.19, p = 0.032). This implies that belonging to a group with better information quality, i.e. knowing the exact probability of continuing to the next round, led to reduced consumption relative to individuals in groups in the ambiguity treatment. The average consumption expected according to the model, assuming an individual at base and level values (as explained in the previous discussion), would go down to 7.59 tokens (from 8.26) if the exact same individual described in the previous section was placed in the risk treatment. This result supports **Hypothesis 8** (Table 19).

The total effect of the resource size is characterised by linear and quadratic terms, as expected. The effect of cpr_{tj} is negative (beta = -0.08, 95% CI [-0.14, -0.02], t(6193) = -2.54, p = 0.011), while the effect of ${cpr^2}_{tj}$ is positive (beta = 0.001, 95% CI [0.0003, 0.001], t(6193) = 3.45, p < .001), and both are statistically significant. This suggests that the resource size affects individual behaviour both positively and negatively depending on whether it is abundant or scarce, confirming **Hypotheses 9, 9a and 9b**. Theoretically, in the model the rate of change in individual consumption relative to the resource size is $\frac{\partial(consum_{tij})}{\partial(cpr_{tj})} = \theta_3 + 2\theta_4 cpr_{tj}$. Setting this equal to zero, and substituting the estimates from the model gives the turning point at which, on average, the resource goes from being considered abundant to scarce. In other words, it is the size at which the effect changes sign. This happens at $\widetilde{cpr}_{tj} \approx 54.9\%$ (using unrounded estimates). In other words, more abundance than this threshold, $\widetilde{cpr}_{tj}$, predicts increased consumption as a result, while below the threshold the effect is negative. Since this is a linear model, these estimates are only the best linear approximation, something like an average effect of an actually quadratic relationship. The calculation is provided here for reference, but the result serves primarily a qualitative purpose – the turning point exists. The actual percentage calculated plays an illustrative role. Better quantitative estimates may be obtained by employing non-linear modelling techniques, which lie beyond the scope of the present analysis.

The effect of others' consumption was statistically significant and negative (θ_5 = -0.15, 95% CI [-0.18,-0.12], t(6193) = -10.04, p < .001), as proposed by **Hypothesis 11**. This collides with a contextual effect of others' consumption, $\overline{others}_{(t-1)j}$, with a statistically significant and positive effect (μ_1 = 0.35, 95% CI [0.31, 0.38], t(6193) = 22.20, p < .001). Such that, while increases in others' consumption result in reductions in consumption for individuals, belonging to a group whose mean consumption is higher, predicts higher consumption levels. The latter confirms **Hypothesis 10**.

As explained previously in Section 6.2.3, the psychological and demographic profile of individuals was modelled to account for within-subject differences in the effect of others' consumption on consumption. Others' consumption was found to significantly interact with gender, intentions to behave selfishly within the experiment, dispositions toward sustainable consumption and psychological distance. Females are found to react to increases others' consumption significantly more negatively relative to males. In other words, the interaction effect between others' consumption and gender (coded as 1 for females) is negative and statistically significant (η_1 = -0.03, 95% CI [-0.05,-0.009], t(6193) = -2.75, p = 0.006). The situation is similar for

dispositions toward sustainable consumption, whose interaction with others' consumption is statistically significant and negative (η_3 = -0.02, 95% CI [-0.03, -0.006], t(6193) = -3.25, p = 0.001). For psychological distance, the opposite is observed, as expected. Shorter psychological distance results in greater sustainable consumer behaviour (SCB) adoption as a response to others' consumption, relative to greater psychological distance. This is characterised in the model by a statistically significant and positive effect estimate for the interaction between others' consumption and psychological distance (η_4 = 0.009, 95% CI [0.002, 0.02], t(6193) = 2.50, p = 0.013). These three interactions are in line with the theoretical expectations laid out in **Hypotheses 12 and 13**. The remaining interaction, with intentions to behave selfishly within the experiment, is discussed below to offer better context.

6.3.2 Behavioural intentions: Abstraction bias and interactions with institutional setting

Concrete intentions, intentions to behave selfishly within the experiment, interacted with others' consumption in somewhat unexpected ways. Namely, in reaction to others' consumption, the interaction term suggests that greater intentions to enact less sustainable consumer behaviour (SCB), predict reduced consumption levels relative to lower levels of said intentions. This is characterised by a statistically significant, negative effect (η_2 = -0.01, 95% CI [-0.02,-0.001], t(6193) = -2.24, p = 0.025). However, this is in contrast with the estimated coefficient of intentions to behave selfishly within the experiment in the model which is much larger, statistically significant and positive (ψ_2= 0.78, 95% CI [0.39, 1.17], t(214) = 3.91, p < .001). This corresponds to one **Hypothesis 2a** (Table 19), which posits that any of the intentions constructs would have a non-negative effect on SCB, and was already confirmed by the structural equation model (SEM) in Chapter 5. One question to consider is whether the range of $others_{(t-1)ij}$ is such that the effect of intentions to behave selfishly within the experiment can actually be reversed. Since $max\left(others_{(t-1)ij}\right) = 54$, then using the model's estimates it follows that $|\psi_2| > max\left(others_{(t-1)ij}\right)|\eta_2|$. Hence, the model only allows for a dampening of the effect of intentions to behave selfishly within the experiment, which is reasonable. This suggests that while concrete intentions are important and significant predictors of SCB, they lose relevance as the consumption of others' increases. Even in the case of concretely operationalised intentions, their potential to predict behaviour is negatively influenced by elements of institutional setting, characterised hereby by others' consumption. This result offers support for **Hypotheses 14, 15**

and 16, which concern the effect of intentions being sensitive to changes in institutional setting, the generalisation of this statement to psychological and demographic factors, and that failure to account for psychological and demographic factors leads to overestimation of their potential for behavioural change, respectively. The first of the three is directly confirmed, while the other two are partially confirmed since other psychological and demographic factors have yet to be fully discussed.

The effect of BIRED was statistically significant and negative (ψ_3 = -0.38, 95% CI [-0.61, -0.15], t(214) =-3.22, p = 0.001). On the other hand, intentions to behave more sustainably (BISUST) did not make into the model due to lack of statistical significance and negatively influencing model fit and the reliability of the results. Both intentions to behave selfishly within the experiment and BIRED are standardised such that they are operationalised in units of standard deviations, suggesting that taking the sample variance as an indication of a unit change in each variable, intentions to behave selfishly within the experiment has in general a stronger effect than BIRED. It is worth noting that BIRED is not modelled as conditional on others' consumption following results of model diagnostics (Appendix G). The effect of BIRED can become stronger than that of intentions to behave selfishly within the experiment if $\left|\frac{\partial(consum_{tij})}{\partial(INT_i)}\right| = |\psi_2 + \eta_2 others_{(t-1)ij}| < |\psi_3| = \left|\frac{\partial(consum_{tij})}{\partial(BIRED_i)}\right|$ is fulfilled. The model and domains of the variables involved do allow for such values. In particular, the left and right hand side of the inequality are equal when $others_{(t-1)ij} = 40$ tokens, meaning that any token beyond the 40th consumed by others would result in the disappearance of the gap between concrete and abstract intentions. It is worth noting that 40 tokens corresponds to a mean consumption by others of 13.3 tokens, which is significantly higher than the mean consumption observed at base values of the predictors, for the ambiguity (8.26 tokens) and the risk (7.59 tokens) treatments. This suggests that for this to happen, the behaviour of others must be significantly unsustainable.

These results suggest that the relevance of abstraction bias in intentions may be reduced by changes in setting, particularly increases in others' consumption. However, to eliminate the influence of abstraction bias, instrumentalised here as the gap between the effects of intentions to behave selfishly within the experiment and BIRED on behaviour, institutional setting must become highly unsustainable relative to what was observed on average in the experiment. Moreover, the most abstract intentions factor BISUST, was not significant enough to be added onto the model, therefore regardless of attenuation due to institutional setting, it is reasonable to consider abstraction bias a significant limitation.

In relation to **Hypotheses 1 and 1a**, which relate to the mediation by more concrete intentions of the effect of abstract intentions on behaviour, there is little this model can add. However, BIRED was hypothesised and modelled in the SEM analysis of Chapter 5 to operate on behaviour moderated by intentions to behave selfishly within the experiment, resulting in support for these hypotheses. Subsequent mediation analysis suggested that BIRED (similar to BISUST) had a non-significant total effect on actual behaviour, confirming **Hypotheses 2 and 2a**, that concrete intentions had a stronger effect on behaviour than their more abstract counterparts. Assuming the mediation structure proposed by **Hypotheses 1 and 1a**, which the mixed model is unable to account for explicitly, it would be reasonable to expect that at least part of the effect of BIRED may correspond to some overlapping variance between BIRED and the intentions to behave selfishly within the experiment factor. An inspection of the model resulting from the removal of the BIRED factor resulted in a stronger and more significant effect of intentions to behave selfishly within the experiment, in support of this interpretation. Given these considerations it is reasonable to conclude that the results are still in line with the results of the SEM analysis, and are in line with a significant manifestation of abstraction bias which **Hypotheses 1, 1a, 2 and 2a** elude to. Particularly since the gap induced by abstraction bias between intentions factors only mitigates under extreme conditions of unsustainable behaviour by others. However, the results do also offer support for **Hypotheses 14, 15 and 16** as discussed, given that some institutional setting conditions were capable of attenuating the effect of intentions on behaviour. This can be considered an explicit manifestation of the intentions-behaviour gap (IBG) as a consequence of the disconnect between intentions and actual behavioural setting, where setting becomes explicit, arguably regardless of their concreteness.

6.3.3 Rebound effects of dispositions and psychological distance: The important role of others' behaviour

As pointed out previously in the context of considering institutional setting effects (Section 6.3.1), the interaction between psychological distance and dispositions, and others' consumption fails to provide the full picture for these constructs. The role of dispositions toward sustainable consumption and psychological distance is discussed in detail below.

As previously discussed in Section 6.3.1, the interaction terms between dispositions toward sustainable consumption and psychological distance, and others' consumption, suggest that in reaction to others' consumption both constructs operate as expected. Namely, higher

dispositions toward sustainable consumption predict lower consumption levels, and the same goes for shorter psychological distance, in reaction to increases in others' consumption. These results confirm **Hypotheses 12 and 13**, which posited that dispositions toward sustainable consumption and psychological distance would influence how others' consumption affects individuals' behaviour. More specifically, that dispositions toward sustainable consumption positively moderates the relationship and psychological distance does so negatively, which was confirmed by the model. However, these effects are in contrast with the model's estimated effects for the dispositions toward sustainable consumption and psychological distance fixed effects. The effect of the DSC_i term is statistically significant and positive (ψ_4 = 1.00, 95% CI [0.57, 1.42], t(214) =4.65, p < .001). Similarly he effect of the PD_i term is statistically significant and negative (ψ_5 = -0.41, 95% CI [-0.71, -0.12], t(214) =-2.75, p = 0.006), suggesting that more dispositions toward sustainable consumption, as well as shorter psychological distance, predict increases in consumption. This suggests that dispositions toward sustainable consumption and psychological distance operate as theoretically expected only conditional to others' behaviour. Not only that, these results are in line with the concept of behavioural rebound effects, whereby a factor or initiative that is considered a driver of sustainable consumer behaviour (SCB) a priori, results in consequences that contradict such an expectation resulting in hindering SCB. For instance, Sun and Trudel (2017) found that the sole existence of a recycling bin in a room, relative to it not being available, led to significant increases in the quantity of the resources used by participants in completing the same series of tasks. Here, feeling closer to climate change (psychological distance) and higher tendencies to consider the environment (DSC) seem to operate similar to the recycling bin. A reasonable interpretation is that having a more environmentally conscious and knowledgeable psychological profile may deplete individuals' sense of responsibility, or provide a sense of comfort (neutralising psychological discomfort), resulting in a rebound effect.

Since the following inequality holds for all possible values of others' consumption, $\frac{\partial(consum_{tij})}{\partial(DSC_i)} < 0$, the model suggests that in fact the rebound effects tend to dominate the role of dispositions toward sustainable consumption. In the case of psychological distance, there are values of others' consumption that result in the expected $\frac{\partial(consum_{tij})}{\partial(PD_i)} > 0$, however these only occur once others' individual consumption averages 15.2 tokens, which is less than 3 tokens away from the maximum potential consumption per round, and well above the average observed for either treatment. Therefore, again the rebound effect dominates the relationship between

psychological distance and behaviour, unless in a situation of extreme unsustainable behaviour by others.

These results also provide strong support for **Hypotheses 15 and 16**, that the effect of psychological factors is sensitive to institutional setting and that failing to account for setting leads to a significant overestimation of the potential of psychological factors to explain actual behaviour. In fact, the uncovered rebound effects suggest that acceptance of **Hypotheses 4 and 6**, that the effect of psychological distance and dispositions toward sustainable consumption on SCB is negative and non-negative, respectively; is conditional on accounting explicitly for institutional setting. It is worth noting that since conditionally on others' consumption dispositions toward sustainable consumption and psychological distance operate as was expected is in line with the findings of the structural equation model (SEM), since behaviour was operationalised relative to that of others. However, the present model offers a look into the black box of institutional setting.

6.3.4 The role of gender: Individual, contextual and interaction effects

The model suggests that gender plays an important role in the emergence of sustainable consumer behaviour (SCB). As discussed previously (Section 6.3.1), gender interacted with other's consumption such that females react to increases in the latter by consuming less relative to males. Contrary to typical findings on gender effects in SCB, the model suggests that a participant being female, ceteris paribus, predicts higher consumption relative to being male. The effect of the fem_i term is statistically significant and positive (δ_1= 1.12, 95% CI [0.20, 2.03], t(214) = 2.41, p = 0.017). Not only that, the model also uncovers contextual effects, whereby the gender composition of the group plays an important role in individual behaviour. The effect of fem_count_j is statistically significant and positive (μ_3 = 0.42, 95% CI [0.03, 0.81], t(70) = 2.13, p = 0.036), suggesting that for each additional female in a group, individuals of that group are expected to consume 0.42 tokens more on average and everything else being equal.

According to the estimates in the model, being female predicts increases in consumption unless others' consumption averages to values greater than 12.4 tokens for everyone else in the individual's group. Therefore, the expected reductions in consumption for female participants are conditional on others' behaviour, to an extent where others must already be consuming well beyond the sustainable threshold. Moreover, the contextual effect of gender contributes to worsening the problem further. Therefore, these results offer further support for **Hypotheses 15**

and 16, as they suggest that demographic factors, in the same way as the psychological factors discussed previously, are sensitive to changes in institutional setting and, failure to account for the latter leads to overestimations of their potential to bring about the right behavioural outcomes. What is more, the contextual effect of groups' gender composition can be considered in itself an element of institutional setting, further supporting the aforementioned hypotheses. Namely, not only is gender sensitive to changes in institutional setting, but gender itself has contextual effects which operate as significant separate elements of setting itself.

Hypothesis 20, which poses that females on average enact more SCB relative to males, was accepted on the basis of the structural equation model (SEM) of Chapter 5. However, similar to the case of dispositions toward sustainable consumption and psychological distance discussed in the previous sub-section, according to the results of the present analysis, **Hypothesis 20** only holds in relation to individuals' reduction in consumption in response to increase in others' consumption. Therefore, its acceptance should be conditional on institutional setting.

6.3.5 Risk aversion

The effect of risk aversion on consumption was statistically significant and negative (ψ_1 = -1.45, 95% CI [-2.88, -0.01], t(214) =-1.99, p = 0.048). This offers further support for **Hypothesis 21**, which was also addressed in the SEM analysis of Chapter 5. The model controls for potential contextual effects of risk aversion by including the cluster mean. Its effect is statistically non-significant and positive (μ_2 = 1.43, 95% CI [-1.48, 4.34], t(70) = 0.98, p = 0.330). In sum, for more risk averse individuals the model predicts reduced consumption levels, i.e. more sustainable consumer behaviour (SCB). Since the range of the risk aversion variable is 1, the estimate, which corresponds to a unit change in the regressor, is the predicted difference in consumption between a minimally and a maximally risk averse individuals, everything else being equal.

6.3.6 Control variables: Learning

The effect of the time variable is statistically significant and negative (θ_1 = -0.03, 95% CI [-0.05, -0.01], t(6193) =-3.33, p < .001). This suggests that consumption is on average reduced to some extent from one period to the next, in a way that other predictors in the model cannot account for. This is consistent with learning which may be taking place as individuals participate in the experiment for longer. An additional explanation is that the more periods played, the more instances of a potential Armageddon event there will be. Therefore, as time progresses in the

experiment, individuals are bound to become more conscious of the reduced probability of survival. This shows the importance of controlling for period in the model to avoid confounding effects. The age variable was statistically non-significant and positive (δ_2 = 0.27, 95% CI [-0.30, 0.84], t(214) = 0.93, p = 0.353).

6.4 Conclusions from the linear mixed model

The linear mixed model fit hereby builds on the results of the structural equation modelling (SEM) analysis by further confirming several hypotheses, and uncovering several nuances that emerge when accounting for changes in institutional setting. Similar to the SEM analysis, the model offers additional support for the positive influence of concreteness of intentions in the consistency between intentions and behaviour. However, said consistency may be dependent on institutional setting, such that high levels of others' consumption mask the effect of intentions. Risk aversion was found to positively influence sustainable consumer behaviour (SCB) adoption, similar to the previous analysis.

The present findings are in coherence with the SEM analysis in predicting decreased consumption levels for higher dispositions, closer psychological distance and females relative to males, but only conditionally on others' consumption. In the model, these effects are opposed by what can be understood as psycho-behavioural rebound effects whereby the effects are reversed when others consume more sustainably. In fact, the rebound effects seem to dominate the effects in all three cases. Moreover, gender is found to play a contextual role in individual behaviour, such that belonging to a group with more females negatively relates to SCB adoption. This is still coherent with the SEM analysis where behaviour was operationalised relative to that of others' in the group. As such, contextual effects which happen at the group level are necessarily masked by such an operationalisation.

The effects of institutional setting are characterised by information quality (treatment), abundance vs scarcity and the behaviour of others. Better information quality (risk vs. ambiguity) positively predicts adoption of SCB. The resource size can be considered a double edged sword, since not only does it incentivise SCB adoption when it is running out, but also disincentivises it when it is abundant. The behaviour of others is arguably the most significant construct of the model. It positively predicts SCB adoption at the individual level but its effect is greatly influenced by psychological factors and gender. Moreover, a contextual effect is uncovered such that

belonging to a group that consumes more on average positively predicts consumption levels (i.e. negatively predicts SCB).

In conclusion, the linear mixed effects model suggests that the findings of the SEM analysis are highly dependent on institutional setting. This highlights the fragility of operationalisations that allow for contextual and even behavioural interpretation. By highlighting abstract attributes of behaviour, they detract from setting and practical considerations surrounding the behaviour of interest, which are in fact critical.

The chapter following this one (Chapter 7) offers an overview of the contributions and findings of this Thesis in relation to extant research. The findings of the analyses conducted in Chapters 5 and 6 are discussed relative to extant findings, articulating their relevance to theory and methodology around intentions and SCB.

CHAPTER 7: DISCUSSION

7.1 Introduction

The previous chapter reported on a linear mixed model (LMM) that was fitted to explore the effect of psychological and demographic factors, as well as institutional setting and its interaction with the former, in enabling or hindering sustainable consumer behaviour (SCB). This allowed for the assessment of the theoretical hypotheses that could not be addressed with the structural equation modelling (SEM) analysis, and the reassessment of some that had already been addressed in Chapter 5. All the hypotheses posed in this Thesis for empirical enquiry were successfully addressed and are shown in Table 23. The table shows whether the hypotheses were accepted ('YES', coloured in green), rejected ('NO', coloured in red) or whether its acceptance or rejection was conditional on institutional setting ('CON', coloured in yellow).

This chapter aims to provide a synthesis and discussion of the findings of this research, in relation to the literature, highlighting the contributions made by the Thesis and its fundamental implications. First, a brief recall of the research objectives and questions of this Thesis is provided (Section 7.2). Next, Section 7.3 offers a discussion contextualising the results within the literature, covering the circular economy (CE) together with theoretical and methodological propositions from this Thesis. Implications and recommendations for stakeholders in the transition toward the CE are discussed in Section 7.4. The chapter then discuses limitations within the context of identifying avenues for further research in Section 7.5. The chapter concludes with a summary of results, focusing on conceptual implications for the CE, in Section 7.8.

#	Hypotheses	Accepted	
		SEM	LMM
H1	Intentions' influence on behaviour is mediated by other intentions that are framed less abstractly.	YES	N/A
H1a	The mediation effect of more concrete intentions, in the relationship between more abstract intentions and behaviour, is positive.	YES	N/A
H2	More concretely framed intentions have a stronger total effect on actual behaviour than more abstract framings.	YES	YES
H2a	The total effect of any framing of intentions on actual behaviour is non-negative. In other words, it is either positive or non-significant (i.e. not sufficiently different from zero).	YES	YES
H3	The relationship between psychological distance and intentions is stronger the more concrete the framing of intentions.	YES	N/A

#	Hypotheses	Accepted	
		SEM	LMM
H4	The total effect of psychological distance to climate change on actual behaviour is negative.	YES	CON
H5	Dispositions toward sustainable consumption positively influence behavioural intentions.	YES	N/A
H5a	The effect of dispositions toward sustainable consumption on intentions is stronger the more abstract their framing.	YES	N/A
H6	The total effect of dispositions toward sustainable consumption on actual behaviour is non-negative.	YES	NO
H7	Psychological distance to climate change mediates the effect of dispositions toward sustainable consumption on intentions.	YES	N/A
H7a	Psychological distance to climate change negatively predicts intentions.	YES	N/A
H7b	Dispositions toward sustainable consumption negatively predict psychological distance to climate change.	YES	N/A
H8	Better information quality positively influences adoption of sustainable behaviour.	N/A	YES
H9	The effect of resource size on adoption of sustainable behaviour depends on whether it is considered abundant or scarce.	N/A	YES
H9a	Resource abundance negatively influences adoption of sustainable behaviour.	N/A	YES
H9b	Resource scarcity positively influences adoption of sustainable behaviour.	N/A	YES
H10	Collective consumption levels positively influence individual consumption levels within the group.	N/A	YES
H11	Others' consumption level negatively influences individuals' consumption levels.	N/A	YES
H12	Others' consumption level negatively influences individuals' consumption levels more for individuals with greater dispositions toward sustainable consumption, relative to lower scoring ones.	N/A	YES
H13	Others' consumption level negatively influences individuals' consumption levels more for individuals that are less psychologically distant from climate change, relative to more distant ones.	N/A	YES
H14	The effect of intentions on the formation of behavioural outcomes is sensitive to changes in institutional setting.	N/A	YES
H15	The effects of psychological and demographic factors on behaviour are significantly sensitive to changes in institutional setting.	N/A	YES
H16	Failure to account for institutional setting results in the overestimation of the significance of the effect of psychological and demographic variables on sustainable behaviour.	N/A	YES
H17	Being female predicts higher dispositions toward sustainable consumption, relative to being male.	YES	N/A
H18	Being female predicts shorter psychological distance to climate change, relative to being male.	YES	N/A
H19	Being female predicts higher levels of intentions to behave sustainably, relative to being male.	YES	N/A

#	Hypotheses	Accepted	
		SEM	LMM
H19a	The positive effect of being a female, relative to being male, on intentions is stronger the less concrete their framing.	YES	N/A
H20	The total effect of being female on SCB, relative to being male, is positive.	YES	CON
H21	Risk aversion positively influences sustainable consumer behaviour.	YES	YES
H22	Concrete intentions mediate the relationship between risk aversion and behaviour.	YES	N/A
H22a	The mediation effect of concrete intentions in the relationship between risk aversion and behaviour is positive.	YES	N/A

Table 23. Hypotheses overview. The table provides an overview of the hypotheses posed for empirical enquiry in this Thesis. The 'Accepted' column states whether the results offered empirical support or not through the structural equation model (Chapter 5) – labelled 'SEM' – or the linear mixed model (Chapter 6) – labelled 'LMM'. 'YES' corresponds to the hypothesis being supported, 'NO' to not being supported, and 'CON' corresponds to the hypothesis being supported conditional on institutional setting dynamics.

7.2 Recalling the research aim and objectives

The present research was motivated primarily by the urgency of rapidly worsening global environmental challenges to which current consumption levels contribute (Hertwich et al., 2010; Rockström et al., 2009; United Nations Environmental Programme, 2013; Steffen et al., 2015; United Nations Environmental Programme, 2019; European Environment Agency, 2020). The prominence of the Circular Economy (CE) in all spheres of society (policy, business and academia), as a solution that is considered to bear significant potential to drive human-economic activity toward more sustainable levels, makes the CE an important and timely issue whose success could depend on the development of proper understanding (Ellen MacArthur Foundation, 2013; Kirchherr, Reike and Hekkert, 2017; Murray, Skene and Haynes, 2017; Korhonen, Honkasalo and Seppälä, 2018). The behaviour of consumers is of critical importance to the success of the CE, but is often overlooked or taken for granted, making it an under researched topic as far as the CE goes (Alcalde-Calonge, Sáez-Martínez and Ruiz-Palomino, 2022; Henriques, Figueiredo and Nunes, 2023). To this end, the present research aimed **to contribute to academic knowledge on CE by enhancing understanding of consumer behaviour through an investigation of the factors that influence the formation of behavioural intentions, and their translation into action, in the context of a transition towards a CE**.

Four research objectives were developed to address this in a comprehensive and systematic manner. The first, RO1, involved the conceptualisation of the role of consumer behaviour in the transition toward a CE and sustainability. The literature review successfully

addressed the conceptual side of this, paving the way for further contributing to this objective, and the other three, by theory and empirical analyses. A particularly relevant input of the literature review to the analytical framework of this Thesis is the explicit identification of sustainable consumer behaviour (SCB) as one of the micro-level foundations of the Circular Economy (CE).

The second objective, RO2, relates to understanding consumer perception relative to the CE, with specific focus on their stated preferences and behaviour, i.e. SCB. The next objective, RO3, relates to identifying the mechanisms that influence the translation of intentions onto actual behaviour. These objectives were largely addressed theoretically by the introduction of abstraction bias, explaining both an important aspect of perception, and a mechanism that operates in the emergence of the intentions-behaviour gap (IBG) in SCB. Additional theoretical contribution was highlighting the important role of institutional setting, which offered a good framework for conceptualising internal and external factors. Methodologically these objectives were also addressed through the design of a mixed experiment-survey study tailored to observation of the IBG in the lab. Moreover, a combination of psychometric and econometric analytical frameworks operated synergically to provide an account of the significance of institutional setting (external factors), relative to internal and demographic factors, in determining behavioural outcomes.

The final objective, RO4, relates to providing recommendations toward the development of the right institutional context in order to drive behavioural adoption toward the CE. The basis for these is provided by the results of the literature review (Chapter 2) and empirical results (Chapters 5 and 6). The present chapter further contributes to this objective by discussing the potential to drive the adoption of SCB based on the results, and proposing strategies to this end. The specific research questions for each objective are addressed in the following chapter (Chapter 8), while the rest of this chapter focuses on contextualising the results within extant research.

7.3 Contextualising and interpreting the results

This section aims to provide a brief overview of the theoretical foundations of this research, hence providing context for the interpretation of the results. The first section summarises the findings of the literature review (Chapter 2), which serve as the theoretical basis for all subsequent conceptualisations and analyses. Next, the theoretical underpinnings of the conceptual framework, which gives rise to the hypotheses that were tested empirically, are briefly

summarised to appropriately position the theoretical contribution of this Thesis relative to extant theories and observations.

7.3.1 Putting consumption in the Circular Economy into perspective

Kirchherr, Reike and Hekkert's (2017) definition of the circular economy (CE) provided the foundations for defining consumption in the CE (Chapter 2). The authors' definition highlights that CE is not only defined in terms of its strategies (means), but also in terms of its goals (ends) (Kirchherr, Reike and Hekkert, 2017; Korhonen et al., 2018). This has important consequences for consumers. In terms of its means, the CE is characterised by strategies classifiable within the nR framework, with an explicit preference for low entropy solutions (e.g. reduce and reuse) relative to higher entropy ones (e.g. remanufacturing and recycling). Europe's waste-management hierarchy (Singh and Ordoñez, 2016; Camacho-Otero, Boks and Pettersen, 2018) illustrates this. In terms of its goals, the CE is characterised by the overarching purpose to attain sustainable development (Kirchherr, Reike and Hekkert, 2017). These observations lead to the conclusion that in fact sustainable consumer behaviour (SCB) is a micro-level foundation of the CE, and inspired throughout this Thesis a focus on how much is consumed (quantity), and the relationship between micro-level consumption and its macro-level consequences. The former represents the lowest entropy solution possible, i.e. reducing, while the latter reflects the goal of attaining global sustainability.

The *IPAT* formula, *Impact = Population*Affluence*Technology*, was used to facilitate considerations of the aforementioned micro-macro interactions (Kara et al., 2022). These considerations lead to the conclusion that while technology can be part of the solution, it is not enough in itself to drive the adoption of SCB when rapid growth in population and affluence are taken into account (Reisch and Thøgersen, 2015). In particular, technological solutions are often limited by rebound effects, whereby they imply side effects which undermine their potential or even reverse their effect (Alcott, 2005; Herring and Sorrell, 2009; Sun and Trudel, 2017). Only through deep institutional changes can sustainability be approached (Vergragt, Akenji and Dewick, 2014). This for consumers translates into a shift away from consumerist cultures toward ones that value more sustainable lifestyles (Brown and Vergragt, 2016). In support of this view is the decoupling of well-being and economic growth which has taken place in affluent nations and has been evidenced empirically (Daly and Cobb, 1989; Mulder, Costanza and Erickson, 2006; Jackson, 2009).

Individual behaviour is affected by its surroundings, and not only determined internally (Jackson, 2005). Therefore, consumers cannot be expected to make such a cultural shift alone when the socio-economic context is dominated by a consumerist rhetoric (Jackson, 2009; Vergragt, Akenji and Dewick, 2014). Not only that, trying to appeal to individual consumers' responsibility alone ignores the important limitations to current understanding of internal mechanisms behind SCB. In particular, there exists a strongly significant mismatch between consumers' stated attitudes and/or intentions, and their actual behaviour, i.e. the intentions-behaviour gap (IBG) (Morwitz, Johnson and Schmittlein, 1993; Ajzen, Brown and Carvajal, 2004; Carrington, Neville and Whitwell, 2010; Carrington, Neville and Whitwell, 2014). This is rarely addressed empirically since most SCB research relies on self-reported data and the formation of intentions, and fail to observe actual behaviour (e.g. Laroche, Bergeron and Barbaro-Forleo, 2001; Loureiro, McCluskey, and Mittelhammer, 2002; Watts, Ilbery and Maye, 2005; Holloway et al., 2007; Van Doorn and Verhoef, 2011). The IBG is thought to have both methodological and theoretical origins, but studies simultaneously accounting for both are scarce (Davies, Lee and Ahonkhai, 2012; Shaw, McMaster and Newholm, 2016; Frank and Brock, 2018).

The above discussion briefly discusses the background to the empirical analyses conducted in this Thesis. This serves the purpose of clearly differentiating this Thesis from the wider context of research on consumption in the CE. The present research accounts for the IBG methodologically by designing the conditions for observing it under controlled laboratory conditions. Theoretically this is also addressed by highlighting the importance of accounting for the effects of both internal and external factors. The latter is an explicit acknowledgement of the significance of institutional setting, which initiatives focused on individual behaviour change often ignore, as discussed previously. Therefore, the present research paves the way for the comparison of the relative significance of internal and external factors on behaviour, such that the need for deeper cultural and institutional change can be empirically scrutinised directly. The results showed that institutional setting can dampen and even reverse the expected effect of psychological factors on behaviour, offering empirical support for the need for an institutional environment capable of cultivating the right behavioural patterns.

Perhaps the most significant factor in determining individual behaviour in the experiment was the behaviour of others. A reasonable interpretation is that the unspoken social contracts that provide the framework for understanding the behavioural choices at hand are paramount, i.e. the normative and cultural-cognitive pillars of the institution at hand. Since participants could

not communicate otherwise, local consumption cultures in groups were created through a high degree of replication of group behaviour by individuals. Moreover, it was with respect to changes in others' behaviour that psychological profiles influenced behaviour as expected, and not in terms of their net effects. In other words, psychological factors come into play at the point of interaction between the normative and cultural-cognitive pillars of institutions. It is still the institutional pressures that dominate, but there are idiosyncratic elements to individuals' reactions to setting that are psychologically based, and in line with expectations based on current knowledge of psychological factors behind SCB. However, in terms of the total effects of such factors, they were often contrary to theoretical expectations.

For consumer behaviour research on the CE, the results have important implications. There is an urgent need to incorporate both internal and external factors into consumer behavioural models in order to understand actual behaviour. It is also necessary to understand internal cognitive processes with respect to their interactions with institutional pressures, given the volatility of current expectations when external influences are accounted for. More generally, the findings of this Thesis imply that it is not realistic to hope that consumer behaviour change, coherent with the CE, will occur by appealing to consumers and their individual responsibilities alone. The foundations of the CE need to be clearly defined and articulated such that they can begin to be legitimised at the regulative, normative and cultural-cognitive institutional levels. Given these conclusions, it follows that for SCB to be really achieved in the transition toward the CE, a shift away from consumerist cultures, toward ones that value more sustainable lifestyles, needs to be promoted and supported by the regulative and normative contexts.

7.3.2 Theoretical propositions: The role of abstraction bias and institutional setting in the intentions-behaviour inconsistency

A methodological limitation that is thought to account for part of the intentions-behaviour gap (IBG) is hypothetical bias (Murphy et al., 2005; Araña and Leon, 2013). This takes place when individuals are unable to make reliable predictions about their behaviour in a given hypothetical setting (Ajzen, Brown and Carvajal, 2004). It is thought to affect self-reported data collection methods since they often rely on individuals considering the hypothetical situations posed (Araña and Leon, 2013). In the conceptual framework (Chapter 3), a mechanism through which this bias may operate was proposed. Namely, the concept of abstraction bias was introduced, which is

broader than hypothetical bias but well aligned, and offers a theoretical foundation for its understanding.

Abstraction bias is rooted in the framework of construal level theory (CLT), which links psychological distance (PD) to construal (abstraction) level of mental representations, and in turn behaviour (Trope and Liberman, 2010). Abstract mental representations of behaviour are thought to relate to values, attitudes and other abstract attributes of the behaviour. On the other hand, concrete mental representations are thought to lead to representations based on concrete attributes of the behaviour, like setting, practical and time limitations (Giacomantonio et al., 2010; Trope and Liberman, 2010). These dynamics between abstraction of mental representations and behaviour forms the basis for abstraction bias. It occurs when the abstraction of the mental representation of a behaviour leads to biased predictions (and hence self-reports) about one's behaviour, due to a disproportionate influence of values, attitudes and other abstract features on the consideration. In other words, abstraction bias is the result of the inability to realistically weigh in the concrete consequences of enacting the behaviour, like how much time it may take or how far one would have to travel.

Construal level theory proposes that there is an intrinsic connection between psychological distance and construal level. Psychological distance is the subjective distance between the self and that which is being perceived (Baltatescu, 2014). It is thought to operate on the spatial, temporal, social and hypothetical dimensions (Trope and Liberman, 2010; Baltatescu, 2014). This shows how hypothetical bias, which just requires increased hypotheticality, fits into this narrative. Since hypotheticality conforms one of the dimensions of psychological distance, the latter is increased as a result of increases in the former. Therefore, the associated mental representation of the behaviour of interest becomes more abstract, which leads to an imbalance between abstract and concrete considerations relative to the actual behavioural context.

This framework is also capable of accounting for the important mediating role of implementation intentions in the intentions-behaviour relationship (Gollwitzer, 1999; Carrington, Neville and Whitwell, 2010; Loy et al., 2016; Grimmer and Miles, 2017). Implementation intentions are specific plans to act on one's intentions, often conditional on external cues (Gollwitzer, 1999). These are essentially concretely framed intentions, since they are less hypothetical and explicitly highlight the concrete attributes of the behaviour-like context. Therefore, their success in mediating the intentions-behaviour relationship, is in line with the notion of abstraction bias. By providing a more concrete framing, so is the mental representation more concrete, yielding more

reliable accounts of actual behaviour. One of the main benefits of abstraction bias is that it offers a unifying framework for understanding several known phenomena that explain the translation of reported intentions into actual behaviour, like hypothetical bias and implementation intentions. A further contribution of the concept is its positioning as a bias, which highlights its potential to be mitigated methodologically.

Hypotheses were developed in order to put abstraction bias to the test empirically by means of structural equation modelling (SEM). Three constructs of intentions, framed at varying levels of abstraction, were at the centre of these hypotheses. These allowed to identify the presence of abstraction bias. Further hypotheses about the roles of dispositions toward sustainable consumption (DSC), psychological distance (PD) and gender (FEM), were developed to test the theoretical predictions of abstraction bias empirically. In particular, that more abstract framings are related to more abstract attributes of behaviour, the importance of psychological distance, and the mediating role of more concrete intentions between more abstract ones and behaviour. As shown in Table 23, all the hypotheses applicable to the SEM analysis were accepted by the results, in support of the proposed operating mechanism for abstraction bias. However, while this is an important finding, it only addresses an internal portion of the behavioural process.

An important contribution of this Thesis is its explicit acknowledgement of the critical role of external factors in explaining actual behaviour. Abstraction bias can be thought as a micro-level cognitive mechanism, which is not enough to explain individual behaviour from an institutional theory perspective (Lounsbury, 2007; Chaney and Slimane, 2014). This was addressed through further statistical analysis, employing a linear mixed model (LMM), which built upon the results of the SEM analysis and provided a point of comparison between the significance of internal cognitive processes and that of institutional setting in determining actual behavioural outcomes. The results are summarised below.

The LMM analysis provided support for all the hypotheses that related to institutional setting (8-16), but resulted in some different conclusions relative to structural equation modelling (SEM), regarding psychological distance, dispositions toward sustainable consumption and gender (see Table 23). The total effects on behaviour that were implied by the SEM, i.e. positive for dispositions toward sustainable consumption and gender while negative for psychological distance, which offered support for the respective hypotheses (4, 6 and 20), was not replicated when accounting for institutional setting dynamics in the LMM. This is further discussed in the following section. This only serves as stronger support for Hypotheses 14, 15 and 16 which overall

related to the significance of the effects of institutional setting, relative to the effect of psychological, demographic and intentions constructs. These results together showed both that abstraction bias is an important mechanism behind the intentions-behaviour gap (IBG), which can be methodologically addressed, and that institutional setting is capable of undermining expectations about individuals' behaviour that are based only on psychological and demographic factors. In other words, there is an urgent need to adopt a neo-institutional perspective that explores the deterministic and strategic fields of the institution of sustainable consumer behaviour (SCB), as well as their interactions.

Hypotheses 2, 2a and 21, relating to the total effect of differently framed intentions and risk aversion (RA) were supported by both models. In the case of intentions, the LMM found institutional setting capable of dampening their effect, but never significantly enough to mitigate it completely. Therefore, concretely framed intentions, compared to dispositions toward sustainable consumption, psychological distance and gender, were able to better withstand (negative) institutional pressures that work to mitigate their effect on behaviour. While their sensitivity to setting was still significant and cannot be ignored when considering actual behaviour, concretely framed intentions emerged as the psychological predictor of behaviour that was most robust to adverse institutional setting conditions. Therefore, these results indicate that by addressing abstraction bias methodologically, for example by using concretely framed intentions and narrowing down the conceptual breadth of behavioural and intentions constructs, more robust conclusions can be achieved. However, ultimately, only by accounting for significant elements of institutional setting can research hope to build reliable knowledge about actual behaviour.

7.3.3 Positioning the results within the theoretical landscape of the intentions-behaviour gap

Current understanding of the intentions-behaviour gap (IBG) can be classified into modeller and methodologist perspectives (Shaw, McMaster and Newholm, 2016; Frank and Brock, 2018). The former argues theoretical reasons for the emergence of the IBG, often modelled to moderate or mediate the intentions-behaviour relationship. The methodologist perspective provides methodological explanations of the IBG, like hypothetical bias (Ajzen, Brown and Carvajal, 2004; Murphy et al., 2005; Araña and Leon, 2013). Within the modeller camp are attempts to explain the IBG through cognitive dissonance and neutralisation mechanisms (Chatzidakis, Hibbert and

Smith, 2007; McDonald et al., 2015; De Lanauze and Siadou-Martin, 2019). There is not much that the results of this Thesis can add to this framework due to fundamental differences in their focus. Namely, cognitive dissonance and neutralisation mechanisms relates to the question of how individuals deal with the psychological discomfort that arises due to the misalignment of their attitudes and intentions, and behaviour, which in turn allows said misalignment to remain (Gregory-Smith, Smith and Winklhofer, 2013). The context of abstraction bias addresses a perceptual cognitive phenomenon which contributes to the emergence of the IBG in the first place. In other words, it responds to why such a misalignment may arise, and not how individuals account for the cognitive dissonance it generates, and psychological discomfort which requires neutralising. Despite that, neutralisation strategies described in the context of cognitive dissonance may offer a good starting point to understand some of the results, as discussed in Section 7.3.5.

An extant modeller perspective which aligns better with the conceptualisations of this research is Carrington, Neville and Whitwell's (2010) model including implementation intentions as a mediator, and situational context and actual behavioural control as a moderators of the intentions-behaviour relationship (Belk, 1975; Gollwitzer, 1999; Grimmer and Miles, 2017). On the one hand, the results of the analyses conducted in this Thesis were in line with the mediating role of implementation intentions and suggested that they could operate by reducing the abstraction with which they are framed, hence reducing the influence of abstraction bias. Moreover, the important role of institutional setting that the results pointed at, is in line with the moderating role of situational context. Broadly, they both relate to external influences on behaviour. However, this Thesis argues for a notion of setting that operates more globally than the concept of situational context suggests (Grimmer and Miles, 2017). By introducing an institutional theory perspective, setting acquires a system-wide status which includes regulative and normative elements. Perhaps due to the global nature of its conceptualisation, which inspired much of the experimental design, setting was found to be such a significant factor accounting for behaviour. That is, in contrast to Grimmer and Miles's (2017) findings that context, conceptualised more locally as situational, was not significant. As such, the results of this Thesis call for a reframing of the role of setting within this framework, such that it encompasses a more complex and global notion. It is worth noting that a broader notion of institutional setting allows for more local elements of context to be incorporated too, but it helps to do so without overestimating their significance.

One response of Carrington, Neville and Whitwell's (2010) model to its rather local conception of context is the inclusion of actual behavioural control as a further moderator of the intentions-behaviour relationship. This refers to the degree to which an individual is able to perform the behaviour of interest. It encompasses necessary skills and environmental constraints to enacting the behaviour (Fishbein and Ajzen, 2011). Therefore, it offers a more diffuse notion of setting which aligns with that of institutional theory. Assuming this interpretation, given the relevance of institutional setting revealed by the results, they are in line with the role of actual behavioural control in Carrington, Neville and Whitwell's (2010) model. The results, and this conception of actual behavioural control highlight that much of consumers' behaviour occurs beyond individual control and intentions.

On the other hand, the results bear an important difference with actual behavioural control, while part of the role of institutional setting was to moderate the effect of intentions on behaviour, elements of institutional setting also influenced behaviour directly and beyond the intentions-behaviour relationship. In other words, the premise argued by this Thesis can be considered a stronger one: Not only can behavioural control and setting influence the translation of intentions into behaviour, but elements of institutional setting can have intricate independent effects, beyond cognitive processes like the formation of intentions and values, that often yield the latter negligible or even counterproductive. An example of this were the psychological rebound effects that were identified when accounting for institutional setting. Namely, more pro-environmental psychological and demographic profiles were found to only lead to more sustainable consumption in response to the behaviour of others' in the group. In most situations, however, the results showed that these a priori green psychological profiles actually led to increased consumption levels in the experiment.

As mentioned previously, the methodologist perspective on the IBG offers methodological reasons for its existence (Frank and Brock, 2018). In particular these view the use of self-reported data as the main source of the problem, and a number of biases are typically blamed. To the best of my knowledge, this research provides the first account of the IBG under laboratory conditions that allow for the observation of actual behaviour. The synthesis of survey and experimental data allowed for the observation of a particular instance of the IBG, on which further theory was tested. In particular, the role of abstraction bias and the relationship of psychological effects on behaviour and institutional setting were explored. Abstraction bias bears a theoretical contribution, as explained throughout this section, since it has a proposed working mechanism

based on the interconnection between abstraction of mental representations and behaviour. However, on top of that it bears a methodological contribution in the sense that it is a bias that can be addressed methodologically, as the results of this Thesis suggest. Namely, more concrete framings of intentions can be used to mitigate abstraction bias hence minimising the IBG for methodological purposes. Its alignment with and potential to explain both hypothetical bias and the mediating role of implementation intentions shows the duality of abstraction bias as a methodological contribution that is theoretically based.

Altogether, the results of this Thesis suggest that both methodological issues and theoretical gaps are responsible for the IBG simultaneously. However, it is hereby argued that the main pitfall is more theoretical than methodological. This is not so much referring to a modelling issue around the intentions-behaviour relationship, but rather the underlying assumption that psycho-demographic factors and inward cognitive processes predict actual sustainable consumer behaviour (SCB) adoption to a significant extent. In other words, the results call for a shift away from individual consumer responsibility, and toward alternative solutions. Coffin and Egan–Wyer (2022) argued for the need to "look elsewhere for transformative opportunities" (p.107), and propose that the *gap* would be better characterised as a *cap* given that it originates primarily beyond the consumers' control. These claims find empirical support in the results of this Thesis. Inward directed cognitive processes play a role in behavioural outcomes that can be understood internally. However, it is ultimately external conditions like information availability, norms and others' behaviour, and the overall consumption setting, that are most salient and more reliably predict behaviour. Moreover, institutional setting was shown to undermine the precision of expectations built around the exclusive consideration of inward cognitive processes like the intentions-behaviour relationship and other exclusively psychological processes. Therefore, the importance of institutional setting was not only attached to its influence on the translation of intentions into actual behaviour, but more generally to the failure of psychological processes to operate as expected when institutional setting was explicitly controlled for.

7.3.4 The Armageddon game: A methodological contribution to the study of the intentions-behaviour gap

An important contribution of this Thesis was the design of a laboratory experiment, the Armageddon game, in which the interconnections of micro behaviour and macro consequences can be explored. These are in fact implicit in any consideration about sustainable consumer

behaviour (SCB), given that by definition it is behaviour oriented toward sustainable development. In the experiment group extractions that are smaller than or equal to the per-period regeneration of the resource are sustainable. Therefore the definition of SCB was deterministic and explicit, and the consequences of unsustainable consumption too. The observed behaviour corresponds to a situation where the definition of what is sustainable is clear, and is representative of actual behaviour by making incentives compatible through actual monetary consequences. In this way the experiment abstracts away from the complexities and indeterminacies of SCB in the real world. These arise due to competing interests of the market and complex problems like rebound effects which undermine the potential of high entropy technological solutions to result in the expected rises in sustainability (Polonsky and Rosenberger, 2001; Alcott, 2005; Hepburn, 2010; Chen and Chang, 2013; Sun and Trudel, 2017). Information overload and scepticism about science, which is at a surge, further contribute to distorting and creating heterogeneity as to what behaving sustainably means (Schlaile et al., 2018; Torma, Aschemann-Witzel and Thøgersen, 2018; Rutjens et al., 2022).

Qualitatively, the experiment serves as an observation platform for a best-case scenario in which sustainability is clearly and homogeneously understood. Therefore, it is a test of the potential of individual action to bring about sustainable outcomes, given that previous research has proposed that gap in understanding may play an important role in the formation of the intentions-behaviour gap (IBG). Average consumption levels of individuals were highly unsustainable objectively and out of 74 groups, only 3 collected the contents of their private funds by reaching the final round without an Armageddon event taking place. This suggests that it is not only due to a lack of information about what behaving sustainably entails, and trust, that people behave unsustainably. Although admittedly the latter also probably plays a role in accentuating the problem further. Moreover, better information was indeed found to relate to more SCB, in support of previous findings, however others' behaviour and even intentions played a more important role (Foti and Devine, 2019). However, the results suggest that one cannot hope to understand SCB based only on the availability of perfect information, especially given the undeniable practical limitations to the provision of perfect information (Schlaile et al., 2018; Torma, Aschemann-Witzel and Thøgersen, 2018; Rutjens et al., 2022).

7.3.5 Inductive inference from the results: rebound effects and gender

As discussed in Chapter 4 (p. 92), the linear mixed model (LMM) analysis conducted in Chapter 6 was in part oriented toward testing theoretical hypotheses, but it also is of a more inductive nature than the analysis conducted in Chapter 5. In other words, beyond the tested hypotheses, some interesting phenomena were uncovered by the model. These still relate to the hypotheses, in fact they refer to unexpected phenomena that led to only partially accepting, and even rejecting, several hypotheses about the role of psychological factors and gender on the overall individual consumption. What is discussed in this section is a theoretical response to the question of why such deviations from theoretical expectations arose, relative to extant research.

The findings of this research offer empirical support for gender being significant demographic factor in the formation of sustainable consumer behaviour (SCB) and its predecessors, in line with extant research (Kollmuss and Agyeman, 2002; Pinto et al., 2014; Nyarko Ayisi and Krisztina, 2022). While women are thought to have more pro-environmental attitudes and intentions, and behave overall more sustainably, these two claims are rarely connected (Nyarko Ayisi and Krisztina, 2022). The reasoning used to argue that women are more sustainable than men is usually based on phenomena that do not relate to pro-environmental attitudes explicitly, such as their tendency to adopt more frugal behaviours, purchase for the household hence dividing their impact among family members, and on average travelling shorter distances (Johnsson-Latham, Sundström and Saar, 2007; Bulut, Kökalan Çımrin, and Doğan, 2017; Bloodhart and Swim, 2020). This leaves the question of how gender operates in relation to the intentions-behaviour gap (IBG) open.

By combining extant findings about environmental attitudes and gender, with the context of abstraction bias, hypotheses were developed to this end. It was hypothesised that gender would align more with abstract framings of intentions and with value-related constructs, which in the model then suggested would result in an enlarged IBG for females. On the other hand, females were hypothesised to still overall adopt more SCB without necessarily implying environmental reasons, as proposed the literature (Johnsson-Latham, Sundström and Saar, 2007; Bulut, Kökalan Çımrin, and Doğan, 2017; Bloodhart and Swim, 2020). The structural equation model (SEM) confirmed an enlargement of the IBG for females, relative to males, despite also showing that overall female participants consumed less. Therefore, this model confirmed all the hypotheses posed. On the other hand, subsequent analysis with LMM, which explicitly controlled for others' behaviour and contextual effects of gender revealed a contrasting picture. Gender was

only found to operate as expected, by reducing consumption levels, as a response to other people's consumption. Moreover, gender composition of the group had a significant effect on individual consumption, with more females in the group resulting in increased consumption levels. Individually, being female also predicted increased consumption levels, hence making acceptance of the hypothesis that females overall consumed less, conditional on institutional setting.

Overall, the alignment of the results presented in this Thesis with extant research was partial. They were aligned with findings about increased environmental attitudes, values and intentions for females relative to males. Moreover, predictions made using abstraction bias were confirmed empirically through SEM. Namely, that due to more salient environmental attitudes, values and intentions, gender effects would relate more closely to abstract representations of the behaviour, making them more prone to abstraction bias. Relative to the overall effect of gender on consumption, SEM results were aligned with the common finding that females are more sustainable. On the other hand, LMM results showed that this finding was conditional on institutional setting, and therefore far from a reliable conclusion. The LMM analysis offered strong evidence that gender did not have the expected behavioural results when controlling for psychological factors, intentions, and institutional setting.

Similarly, the linear mixed model (LMM) (in disagreement with the structural equation model, SEM) uncovered behavioural rebound effects that operate through the greenness of one's psychological profile. Behavioural rebound effects occur when the outcome of interest is individual behaviour. For instance, Sun and Trudel (2017), found that just making recycling a possibility to individuals results in a significant increase in their use of resources under otherwise equal conditions. The LMM suggested that the psychological profiles characterised by higher dispositions toward sustainable consumption and closer psychological distance to climate change, only affected behaviour positively conditional on others' behaviour. Otherwise, their effect was reversed, therefore giving rise to a behavioural rebound effect. A similar situation was uncovered for gender, this is thought to further strengthen this idea more generally. As discussed previously, there exist consistent findings regarding females' more salient reported environmental values, attitudes, consciousness, and knowledge (Kollmuss and Agyeman, 2002; Pinto et al., 2014; Nyarko Ayisi and Krisztina, 2022; Essiz et al., 2023). Since most of these are unobserved but relate strongly to gender, it is reasonable to conclude that these are responsible for the observed rebound effect.

A particularly novel contribution of these results is showing that while gender indeed relates to greater dispositions toward sustainable consumption and shorter psychological distance, and other environmental value-related constructs, these can rarely explain their adoption of actual SCB. In particular, even when found to behave more sustainably overall, female participants showed stronger signs of abstraction bias, and hence a greater IBG. A further mechanism was uncovered whereby greener psychological profiles, more characteristic of females, acted to reduce SCB, against what is theoretically expected. This is considered a type of rebound effect, which has not been documented to date. Therefore, even the sustainability-orientation of one's psychology can fall victim to rebound effects.

A reasonable explanation is this may operate by reducing psychological discomfort associated with behaving in misalignment with one's values and overall psychological profile. Having a greener psychological profile, implying a tendency to consider the environment more in general and feel more aligned with the pro-environmental narratives, can serve as a neutralising or responsibility-depleting agent for the cognitive dissonance that would otherwise keep behaviour and psychology in coherence (Chatzidakis, Hibbert and Smith, 2007; McDonald et al., 2015; De Lanauze and Siadou-Martin, 2019). This results not only in a non-significant effect of 'being more green' on behaviour, but a reversed overall effect, thereby embodying a rebound effect that operates purely psychologically and internally. The neutralising role of a greener profile or identity could for example operate through guilt, which has been linked to green psychological profiles, and could serve as a currency valued by the sacrifice that green consumers constantly make, exchanged for local unsustainable behaviours (Barbeta-Viñas, 2023).

7.4 Implications and recommendations for stakeholders

The Circular Economy (CE) has the potential to build the right institutional context to make human-economic activity more sustainable. The concept's close relationship to systems thinking, design and business model innovation equips it with an ability to change the resource consumption landscape significantly, but also to evaluate the relative externalities associated to these changes by means of environmental and economic accounting methods, and their combinations (Ellen MacArthur Foundation, 2013; Kirchherr, Reike and Hekkert, 2017; Park and Armstrong, 2017; Catulli, Cook and Potter, 2017; Santagata et al., 2020; Oliveira et al., 2021). However, as the results of this Thesis point, the CE's success is still not guaranteed and requires a coherent efforts from all stakeholders, policymakers, industry-businesses and academia, as well

as consumers. Implications of this Thesis' results, and recommendations for each stakeholder in the CE are discussed in this section. A synthesis of the recommendations emanating from this discussion is presented in Table 24 below, organised into three different stakeholder groups: Policy, management and consumers/citizens.

Stakeholder	Recommendations
Policy	Better defining what 'sustainable' or 'green' refers to in policy and regulation can make consumers' stated preferences better reflect actual behaviour by creating a coherent institutional setting and reducing abstraction of mental representations, and in turn the intentions-behaviour gap.
	It is necessary to move beyond greening consumer preferences, and into building the right institutional setting and incentives structures for sustainable behaviour to arise.
	Policy's role must acknowledge its power and hence responsibility to begin to address global environmental crises by setting societal goals that reflect the needs of society, i.e. wellbeing and sustainability, beyond incessant economic growth.
Managers	Marketing needs to be transparent and directed toward the promotion of more sustainable lifestyles, e.g. highlighting benefits of non-ownership, durability, repairability and recoverability.
	Incorporation of leasing, repair, remanufacture and recovery services into business models.
	Through marketing and supply, businesses form much of the institutional setting relevant to consumption. In this vein, the circular economy poses an opportunity for innovation and highlights the responsibility to better align business incentives with citizens' needs.
Consumers/ citizens	Individuals should become more weary of marketing and messaging claiming a given action to be sustainable, since this can rarely be confidently established without extensive environmental and economic assessment.
	Individuals' responsibility to make local individual choices sustainable should be replaced in favour of the responsibility to work towards, and advocate for, the right institutional setting.
	Individuals may have a better chance of achieving more sustainable lifestyles and behaviours by becoming better informed from scientific sources (rather than marketing), advocating for better information and sustainability assessment, and other strategies that can help improve institutional setting.

Table 24. Summary of recommendations organised by circular economy stakeholders.

Policy implications and recommendations

The European Green Deal (EGD) is a set of policy initiatives put forward by the European Commission to reflect the regulative means that are envisaged to achieve climate neutrality by 2050 (European Commission, 2019). What this means in practice, according to the EC, is building

an economy with net-zero greenhouse gas emissions. The European Climate Law, made the objectives of the EGD legally binding in July 2021 (European Parliament, 2021). The EGD is considered one of the most ambitious and current policy frameworks aiming for sustainable development internationally, and is thought to legitimise concern for sustainability in Europe (Eckert and Kovalevska, 2021). Importantly for this research, the circular economy (CE) concept has influenced much of the EGD (European Commission, 2019). It has been shown that despite the EGD's apparent ambitions, there still exists an important misalignment between politically motivated discourse around sustainability, and discourse around the same matter by environmental and social research scholars (European Commission, 2019; Vergragt, Akenji and Dewick, 2014). Practices that scholarship often identifies as unsustainable are still valid under the conceptions adopted by the EGD (Eckert and Kovalevska, 2021). As illustrated by the results of this Thesis, current sustainability challenges are difficult enough to address, even in unrealistic contexts of perfect information (like the Armageddon game). Achieving sustainability goals will require aligning policymaking with science, in order to build resilience as our understanding of sustainability improves constantly. In the remnant of this section, the results of the Thesis are shown to further highlight the problems of current policy-motivated conceptions of sustainability from a consumer behavioural perspective and recommendations are provided.

A successful transition to a CE is one which aligns with its fundamental premises of a hierarchical preference for low entropy initiatives, and the attainment of sustainable development. Only through this lens can policy act in favour of a successful CE. Policy's current focus on individual responsibility and high entropy solutions is not only certain to fail, but it can in fact further hinder the transition due to unpredictable rebound effects (Alcott, 2005; Herring and Sorrell, 2009; Catlin and Wang 2013; Sun and Trudel, 2017). The results of this Thesis unveiled the strong significance of institutional setting, and the lack of robustness of individuals' rational choice mechanisms to institutional dynamics. In light of these, there is an urgent need for policy to adopt a more central role. Policy's role must acknowledge its power and hence responsibility to begin to address current global environmental crises, moving beyond appealing to individuals' responsibility.

Policymakers in affluent nations should re-consider whether progress should be measured solely based on economic growth, given that the latter already decoupled from peoples' wellbeing long ago (Daly and Cobb, 1989; Mulder, Costanza and Erickson, 2006; Jackson, 2009). In other words, the only thing these incessantly growing economies are progressing toward

is more (un)economic growth. The CE, if appropriately implemented in line with its fundamental premises, has the potential to re-define societal progress in terms of actual societal goals, i.e. wellbeing and sustainability. Within such a framework some economic growth may be desirable, but to a different end than just growth itself. Therefore, for the right regulative context to arise relative to the successful CE-transition, a first step for policy is to separate its means from its ends, both of which are currently perpetual economic growth.

Determining the economic and environmental impacts of each CE strategy that is proposed is a challenging enough task in itself, hence the implicit preference for low-entropy solutions (Santagata et al., 2020; Oliveira et al., 2021). However, this becomes near impossible when policy and societal goals are not aligned, giving rise to competing messages and unclear information (Polonsky and Rosenberger, 2001; Hepburn, 2010; Korhonen et al., 2018). The consumer cannot be expected to act more sustainably when what that entails is subjected to such conceptual distortion. Therefore, policymakers need to accept the limitations to solutions that are based on individual behaviour change. Only through a clear definition of societal goals, and an alignment of regulations to these can the CE be expected to succeed and not become a macro-level case of greenwashing.

In sum, the CE concept itself may be equipped with all the necessary elements to maximise humanity's potential to address environmental crises. However, these are only tools, and their mode of application is highly dependent on the incentive structure that governs their use. Therefore, policymakers should acknowledge their responsibility, which is implicit in their power, to ensure that the principles of the CE are rightfully applied. Failure to do so can result in the unravelling of a kind of CE that is not only unsuccessful, but can further aggravate the problem due to rebound effects.

Managerial implications and recommendations

Given the growth and diffusion of the CE concept in recent years, academia, policy, and society overall, businesses are faced with a need to adapt (Ellen MacArthur Foundation, 2013; Korhonen, Honkasalo and Seppälä, 2018; European Commission, 2018). Despite that, this can also be seen as an opportunity to shape the future through innovation and marketing. However, in light of this Thesis' results the risk for innovation and marketing to be directed away from a successful transition to the CE are high. Within a system that allows for and incentivises consumerist cultures, any a-priori sustainability-oriented innovation can fall victim to rebound effects, and

marketing becomes by definition the tool for the perpetuation of consumerism. While businesses may find this financially beneficial locally, the urgency of the sustainability crisis and the rapid growth of the CE concept suggest that true long-lived success of innovation currently lies precisely on the potential to transform what consumption means for society. High-entropy initiatives currently dominate the market, which suggests that low-entropy solutions, apart from aligning best with the CE, have the most potential for innovation and market differentiation. Managers are urged to make marketing transparent and repurpose it toward the promotion of lifestyles that better align with a culture of sufficiency and sustainability. For example, through marketing of the benefits of non-ownership, durability, repairability and recoverability, and the incorporation of leasing, repair, remanufacture and recovery services into business models.

Additionally, managers should be weary of market and consumer research that is based on identifying 'green' consumer segments, or uses 'psychological greenness', to build expectations about actual consumer behaviour. As the results of the Thesis showed, much of the intentions-behaviour gap, and behaviour in general, occur beyond the consumers' control. The experiment showed that information quality was a significant predictor of adoption, which highlights the importance of marketing in shaping consumer behaviour. As such, businesses have financial incentives to better align with the CE concept, since doing so offers great potential for innovation and market differentiation, but not only. Given the market's control over much of the consumption and general setting surrounding consumers, which is essentially control over consumer behaviour, there is an ethical need to align businesses' and consumer (or more generally citizens) incentives.

In sum, the transition toward a CE presents itself as both a need to adapt and an opportunity to innovate for businesses. Innovation guided by the concept of the CE as proposed in this research implies transformative shocks to the current status quo, that are guided by a preference for low-entropy CE-initiatives. Simultaneously, to support these, marketing must shift its purpose from the perpetual creation of new consumer needs and consumerism, and toward understanding and addressing consumers' needs while promoting lifestyles and cultures that align better with low-entropy modes of consumption.

Implications and recommendations for consumers/citizens

The results of this Thesis have highlighted a lack of actual control of individuals regarding the sustainability of their own behaviours, at least relative to their stated intentions and preferences.

For instance, the gap between intentions and sustainable consumer behaviour (SCB), the intentions-behaviour gap (IBG), was shown to fall primarily beyond individuals' control. Moreover, preferences and individuals' psychology relative to sustainability did not always have the expected effect, suggesting that psychological rebound effects may emerge, leading to situations where one's psychological 'greenness' can in fact lead to more unsustainable actions, within certain institutional setting conditions. This could operate as a neutralisation strategy, whereby individuals who are increasingly sustainability oriented could use this increasingly as a way to deal with psychological discomfort, which may otherwise prompt them to act more in accordance with their preferences (Chatzidakis, Hibbert and Smith, 2007; McDonald et al., 2015; De Lanauze and Siadou-Martin, 2019). Institutional setting, i.e. the information, contextual conditions (regulation, marketing…) and environment in which behaviour occurs, has much more to say about actual behaviour than individual psychological differences can. Individuals need to become aware that due to biases and other involuntary mechanisms, being sustainability oriented has usually little to say about the actual sustainability of one's actions in practice. As such individuals' responsibility to make local individual choices sustainable should be replaced in favour of the responsibility to work towards, and advocate for, the right institutional setting.

The ambiguous communication that stems from greenwashing, of what behaving sustainably entails, only worsens the aforementioned issues. Regulation is not sufficiently scientifically based to articulate a strong conceptualisation of sustainability, and this paves the way for greenwashing in marketing and other communications. Overambitious claims regarding the sustainability of a given product or practice are likely to occur when rebound effects are neglected and a proper environmental-economic assessment of the system required for its application has not been carried out. This has financial benefits for businesses who can reduce their marketing costs, and since it is hard to regulate against when the definition of sustainability in policy is not aligned with the scientific view, such misleading communications are to be expected. For individuals, developing a more critical stance toward strong claims of sustainability can help drive a culture of transparency in communications. In doing so, individuals can claim their freedom of choice regarding the extent of their engagement in sustainable behaviour, and help to reduce its misalignment with intentions. Therefore, individuals are urged to become more weary of marketing and other communications claiming a given action to be sustainable, since this can rarely be confidently established without extensive environmental and economic assessment.

The issue of unsustainable consumption is often wrongly framed as an individual level problem, with solutions focused on adopting a few basic high-entropy behaviours that are typically promoted, e.g. recycling. However, the reality is quite different and better characterised as a cap that has been reached on how sustainable individual behaviour can become given the current institutional setting (Coffin and Egan–Wyer, 2022). Therefore, driving a transition toward sustainability at the individual level may have more to do with striving for and advocating for the right institutional context culturally, normatively and at the regulative levels. Individuals have a better chance of achieving more sustainable lifestyles and behaviours by becoming better informed from scientific sources (rather than marketing), advocating for better information and sustainability assessment, and other strategies that can help improve institutional setting.

7.5 Limitations and further research

The literature review conducted in Chapter 2 took a narrative-critical approach to analysis in order to offer greater interpretative freedom and qualitative depth. This offers less systematicity than other more structured approaches (Grant and Booth, 2009). To address this to an extent a systematic keyword search was applied at the last stage of the review, and snowball sampling was used in the rest of the review. The focus of the review was bridging extant knowledge on sustainable consumer behaviour (SCB) and with the concept of a transition to a circular economy (CE), by identifying extant research problems and gaps. This resulted in a research design and conception of SCB that was broad and focused on the quantity of consumption rather than its qualitative aspects. As a result, some more specific and less researched consequences of the CE concept, that require consumer involvement, were not explicitly considered, e.g. Product-as-Service-Systems, collaborative consumption, stakeholder involvement in product design etc. However, research on these can still benefit from the methodology and results of this Thesis. There is a need for consumer research to explore the behavioural differences of these CE implications and alternative modes of consumption. In particular, given that they imply new 'rules of the game', these align well with the conception of institutional setting and research design developed in this Thesis. Within this context, studies exploring how the rules and mechanisms that govern these CE-related consumer interactions (i.e. institutional setting elements) shape their behaviour, is of particular interest. Added to that is the understanding of, not only behaviour in itself, but also the interactions with institutional setting of the effects of psychological factors on behaviour.

Some of the limitations of this research are related to the measurement model used in the structural equation modelling (SEM) analysis. Namely, the 18 psychological distance items were partly problematic, leading to a factor that was primarily focused on one of the psychological distance dimensions. This problem was thought to arise primarily as a result of the use of reverse coded items, and to be aggravated by their administration in Spanish (Venta et al., 2022). While the resulting 4-item factor showed satisfactory signs of validity and reliability, it must be acknowledged that its content may not appropriately represent the psychological distance fully. Further research would thoroughly benefit from the development and rigorous validation of a psychological distance to climate change scale, in particular for further administration to Spanish-speaking samples. In addition to this, intentions that were concrete to the experimental setting were developed on an exploratory basis. This led to satisfactory signs of validity, but a slightly lower than typical stringent standards reliability (AVE<0.5). Admittedly, further face validity checks and refinement of the items may have yielded a more reliable scale. Therefore, further validation for these kind of experiment-specific scales would greatly benefit the reliability of the results.

Finally, the linear mixed model (LMM) presented in Chapter 6 included random intercepts but no random slopes. When randomness does affect the slope, or effect, of the independent on the dependent variable, failing to account for it can lead to increased Type I error rates. This was not done in the present research due to the inclusion of a large number of fixed effects and a primarily hypothesis testing focus. Moreover, random slopes were not included in others' consumption in order to attribute all explanatory power to the interactions included with psychological factors (i.e. assuming any variation to not be random). Further research and analysis along these lines, focusing less on the testing of hypotheses and more on drawing reliable inference from the data, would benefit from considering less fixed effects to allow for greater complexity in terms of random slopes, and hence greater reliability on the significance of phenomena uncovered.

In addition, the LMM included a quadratic term for resource size to account for the opposing effects of scarcity vs. abundance. More reliable results can be obtained to this end using non-linear modelling techniques. Despite that, omitting the quadratic term would have caused more problems than it would have solved. This is because there is a good theoretical reason to expect this quadratic effect of resource size, therefore, a linear approximation would not only be impossible to interpret but could potentially bias the results more than anything. Altogether,

further research is needed to explore these dynamics of the effect of resource availability on consumption using non-linear modelling.

Further research on consumption in the CE must recognise the institutional nature of consumption, and explicitly discuss elements of choice of study relative to the hierarchy of preference of CE-strategies and the impacts associated with the subject of study. Uncovering the institutional determinants of the divergence from consumerist cultures are of particular relevance to consumer research on the CE. In addition to that, the complex interactions between internal cognitive processes and external institutional setting elements require further exploration. In sum, there is a need for consumer research that adapts theory to setting, and the research design conducted in this Thesis offers a particularly relevant framework to that end.

7.6 A summary of results and their conceptual implications for the Circular Economy

This Thesis addressed its aim and objectives by contributing to knowledge on consumption in the circular economy (CE). More specifically this was done by examining the intentions-behaviour gap (IBG) in sustainable consumer behaviour (SCB), and proposing a conceptual framework for its understanding. Additionally, a research design was proposed to facilitate the assessment of the IBG empirically. In so doing, important implications for research on consumption for the CE were uncovered. Namely, the significance of abstraction bias should be acknowledged as an important source of the IBG, and methodologically minimised through the use of concretely framed intentions, when drawing conclusions about actual behaviour. Abstract framings of intentions may have something to say about consumers' psychological profiles (values, dispositions etc.), but they fall short of accounting for actual behaviour. The significance of concretely framed intentions was conditional on institutional setting, and non-significant when framed abstractly. Despite that they were more robust to institutional setting dynamics than individuals' green psychological profiles. The latter were shown to be highly conditional on institutional setting and to fall victim to a rebound effect, whereby greater dispositions toward sustainable consumption and shorter psychological distance predicted in fact increases in individual consumption when institutional setting was accounted for. Perhaps most importantly, and in line with the CE concept, the results suggest that understanding SCB requires a institutional theoretical (or systems) perspective. To avoid creating unrealistic expectations, the CE must approach knowledge on consumer behaviour by considering both internal and external factors, and the

complex interactions between them, to which the present results pointed. Driving the success of the CE from a consumer perspective must go beyond individual responsibility, and through a divergence from consumerist cultures and lifestyles.

CHAPTER 8: CONCLUSION

8.1 Introduction

The chapter preceding this one provided a synthesised account of the results of this Thesis discussing them in relation to the extant theoretical and empirical research. This chapter is the final chapter of the Thesis and seeks to provide an overview of the outputs of the research that has been presented in Chapters 1 to 7. It begins by summarising the main theoretical and empirical contributions in response to the research questions developed in this Thesis in Section 8.2. The next section discusses contributions from this Thesis (Section 8.3). A concluding statement is provided in Section 8.4.

8.2 Responding to the research questions: a summary of key findings

The present research was guided by the overarching aim **to contribute to academic knowledge on CE by enhancing understanding of consumer behaviour through an investigation of the factors that influence the formation of behavioural intentions, and their translation into action, in the context of a transition towards a CE.** To address this, four research objectives were developed, which were successfully addressed by this Thesis, as briefly outlined in Section 7.2. This section offers a closer look and a synthesised response to the research questions posed as part of each objective, summarised in Table 25. Rather than responding to each separately, since the research questions work in harmony rather than being separate pieces of the puzzle altogether, a broader discussion is provided to address all the questions in a synthesised manner.

Research Objectives	Research Questions
RO1: To identify the role of consumers in the transition towards the CE and sustainable development.	**(1.1)** What role is the consumer expected/required to play in achieving a successful transition towards a CE and how can this role be elicited?
	(1.2) How is consumption in the context of a CE to be conceptually understood and what is its role in the attainment of sustainable development?
RO2: To identify how consumers perceive the CE, by focusing on their stated preferences and behaviour.	**(2.1)** How do consumers perceive the CE and associated behaviours as evidenced by their stated preferences?
	(2.2) What role does consumers' perception play in their adoption of sustainable consumer behaviour?

Research Objectives	Research Questions
RO3: To identify the mechanisms that influence the translation of consumers' intentions into actual CE-oriented behaviour.	**(3.1)** What consumer behaviours characterise the CE and how have they been conceptualised in existing literature? **(3.2)** What are the most prominent theories and conceptual models used to understand CE-oriented behaviour currently? **(3.3)** What are the internal and external factors that determine the formation of the consumer's intentions to behave sustainably and their consequent translation into action? **(3.4)** How do these factors interact to drive or hinder the formation of CE-oriented behavioural intentions and their translation into action?
RO4: To provide recommendations and insight toward the development of the right institutional context (regulative and normative) in order to fill current gaps in consumers' adoption of CE practices.	**(4.1)** *Given the factors and mechanisms identified for RO3*, **(3.1)** Which of the identified factors can be externally perturbed in order to drive sustainable consumer behaviour and to close the current gap in the adoption of CE-practices? **(4.2)** Therefore, what strategies, targeting the identified factors, can be employed to drive the adoption of CE-initiatives?

Table 25. Recalling the research objectives and questions.

A successful transition to the CE is one where its defining conditions are met. Namely, that low entropy initiatives are preferred to higher entropy ones given the availability of both, and to achieve a state of sustainable development (Kirchherr, Reike and Hekkert, 2017). As such, an appropriate conceptualisation of consumer behaviour in the CE should explicitly account for these features, i.e. sustainable consumer behaviour. The consumption behaviours that individuals are urged to adopt to reduce their externalities are typically high entropy solutions like recycling. Consumers are usually expected to prefer green consumption alternatives which is why green marketing campaigns aim to appeal to consumers based on green attributes of products and services, i.e. green consumerism (Barnett, Cafaro and Newholm, 2005; Brunk, 2010; Testa, Sarti and Frey, 2019). This status quo of attempts to drive more sustainable consumer behaviour (SCB) adoption do not align with the first fundamental premise of the CE.

Not only are low-entropy solutions not preferred but they are often considered marginal and too radical, while high-entropy solutions are encouraged and positioned as significant (Alcott, 2005; Bruhn and Lowrey, 2012; Millward-Hopkins et al., 2020). In reality, they also fail to align with the second fundamental premise of the CE, the goal to attain sustainable development.

High-entropy solutions not only insufficient, but they can easily become counterproductive due to rebound effects, which have been shown to also operate behaviourally (Alcott, 2005; Herring and Sorrell, 2009; Sun and Trudel, 2017). Due to these effects, green consumerism can neutralise potential psychological discomfort that would otherwise arise from behaving unsustainably (Catlin and Wang 2013; Sun and Trudel, 2017). The findings of this Thesis suggest that the issue of rebound effects can also operate psycho-behaviourally. Even one's green psychological profile can serve to neutralise the cognitive dissonance of behaving less sustainably locally. In other words, framing green consumerism as a solution to the global issue of sustainability is in fact very likely to only accentuate the problem and become an issue of market dynamics, completely independent of any sustainability-oriented cause and knowledge. Not only that, but the results suggest that even the promotion of adopting 'green' identities has potentially the same contradictory effect.

The results suggest that consumption in the CE cannot be approached from the point of view of individual responsibility which dominates currently. Even when consumers are ultimately willing to adopt more sustainable behaviours, or intend to do so, much of their behaviour originates beyond their control. This is partly exacerbated by poor information quality which arises due to competing interests of the market and the evolving nature of scientific knowledge, which can work to distort consumers' understanding of what SCB entails (Polonsky and Rosenberger, 2001; Schlaile et al., 2018; Torma, Aschemann-Witzel and Thøgersen, 2018; Rutjens et al., 2022). The results did show that better information quality related to more SCB, however this was only a small part of institutional setting. Additionally, the provision of perfect information is practically impossible, and highly unlikely when the sustainability of solutions that are promoted can only be assessed through complex environmental accounting methods which are not accessible to the typical consumer.

The role of the consumer in the CE is more nuanced than currently dominant attempts to drive SCB would imply. Consumers are the micro-level agents of the institution that is consumption. The role of consumers should be understood in this sense as dual. On the one hand, a deterministic (static) stage should be recognised whereby the micro-level behavioural outcomes are a consequence of legitimacy solidifying at the regulative, normative and cultural-cognitive pillars. On the other hand, consumers are capable of shaping institutions at the strategic (dynamic) stage of the institutional field (Scott, 2008; Chaney and Slimane, 2014). At the deterministic stage, consumer behaviour falls mostly beyond the individual's control, it is

essentially a consequence of the system in which it occurs. The results of this Thesis highlighted the necessity to acknowledge this explicitly by showing that institutional setting was not only more significant than cognitive processes in determining SCB, but that under given institutional contexts cognitive processes were altered and often counterproductive.

With respect to the strategic stage, concretely framed intentions did predict increased SCB in the empirical analyses. Therefore, understanding internal cognitive aspects of consumers is important in order to understand how these can ultimately push the institution toward a more desirable state. However, the results overall showed that the potential for understanding the bottom-up, strategic, stage of institutions without accounting for the deterministic, static stage is very limited due to the lack of robustness of purely cognitive-behavioural models to institutional dynamics. This is in line with Vergragt, Akenji and Dewick (2014) suggestion that making consumption sustainable has to go through important changes to the system including policy, consumers' dominant lifestyles and consumption cultures.

At the cognitive-perceptual level, the results showed abstraction bias is a significant mechanism through which individuals' perception relative to SCB operates. In particular, individuals mentally construe or represent behaviours at varying degrees of abstraction (Giacomantonio et al., 2010; Trope and Liberman, 2010). Abstract representations relate to values, dispositions and other abstract attributes to which the behaviour relates, while concrete representations highlight the concrete consequences and context of enacting the behaviour, such as specific constraints, increased costs and so on. This has behavioural consequences that operate on a continuum of abstraction, i.e. behaviour becomes more consistent with intentions the more concretely they are framed, hence narrowing the intentions-behaviour gap (IBG). This points to a potential benefit of the CE's typical focus on its mechanisms rather than its goals, which may be a consequence of its design and engineering bases (Ellen MacArthur Foundation, 2013). By framing behaviours that align with the CE and doing so by describing its specific mechanisms, e.g. a specific kind of business model, a more concrete representation of the behaviour is constructed. Therefore, consumers may be more able to generate behaviourally reliable expectations about their intentions and willingness to engage in CE practices. It is reasonable to conclude that the reliability with which stated preferences for CE practices can describe actual behavioural outcomes, can be maximised through concrete conceptualisations that highlight context and specific action, which minimise the effect of the IBG. However, even when minimising the IBG, one cannot hope to understand actual behavioural outcomes without

considering institutional setting. As explained previously, bottom-up approaches can only be significant relative to their potential to drive institutional change. Abstracting the problem away from the institutional setting in which behaviour takes place implies a high risk of generating conclusions that do not align with real consumer behaviour.

The following section briefly outlines the main contributions of this Thesis.

8.3 Summary of contributions

This section provides a brief account of the main theoretical and methodological contributions of the present research.

It contributed to literature on consumer behaviour and CE by conducting a critical review of the literature which opened the door to a conceptualisation of what constitutes consumption in the CE. The review offers a theoretical basis for further research to build a holistic perspective on consumer behaviour that is in line with the systems perspective characteristic of CE. It provides a critical perspective on which further research can ground more holistic conceptions of consumer behaviour in the CE, and the claim that individual responsibility is likely not enough. A fact subsequently supported strongly by the results.

This Thesis contributed theoretically to understanding the intentions-behaviour gap (IBG) by theorising and testing the validity of the concept of abstraction bias. This unifies notions from construal level theory (CLT), the goal-attainment literature (implementation intentions), and the methodological issue that is hypothetical bias. The results provided empirical support for the significance of abstraction bias. This offers an important contribution to the literature on IBG, but also consumer behaviour and CE literature. In particular, it provides a broader framework within which to understand deviations from one's self-reports. Moreover, abstraction bias is a theoretical contribution first, but it also conforms a contribution to methodology since it opens the door to addressing the IBG at the stage of construct operationalisation.

An important theoretical contribution of this research, which is methodologically facilitated by the experimental context that was designed, was the explicit consideration of institutional setting dynamics. Not only that, but also their interaction with psychological factors, which uncovered the emergence of rebound effects that operate internally. In other words, it was individuals own green identity or psychological profile that resulted in decreased sustainable consumer behaviour (SCB) adoption, presumably due to these effectively depleting or neutralising their sense of responsibility. These contribute to research on IBG and SCB, as well as

the CE by paving the way for further research to explore the nuanced interaction between cognition and institutional setting.

The use of a research design combining survey and experimental methods in the study of the IBG in SCB was a first. Despite the crystal clear connection of observations of the IBG to the context of self-reported behavioural scales and the use of the theory of planned behaviour, the best attempts to observe behaviour directly took place in the field. While field experiments have benefits in the form of realism, their results are not easy to generalise beyond the field context imposed. Therefore, the use of incentive compatible experiments, and the combination of these with surveys, allowing for the observation and exploration of the IBG in the laboratory is an important contribution to research and methodology on the IBG. Moreover, the experimental context in question allowed for the control of institutional setting dynamics, which were shown to be important both in terms of the IBG and SCB as a whole.

Potentially less noticeable contributions of this research were the operational definition of SCB and institutional setting. The definitions developed here were carefully constructed to satisfy both conceptual rigour and the well-definition of quantitative operationalisations of each. This provides the SCB and CE literature with a basis on which to quantitatively consider institutional setting and behaviour in a manner that is conceptually sound and mathematically well defined.

A further contribution of this Thesis, more relevant to the context of game theory and experimental economics, was the design of a new common pool resource game, the Armageddon game, in which the survival of the world depended on the size of a renewable resource. This opens the door to the construction and testing of theoretical modes, the calculation of theoretical equilibria and the need to understand the nuances of the game experimentally.

8.4 Concluding remarks

Overall, the research reported in this Thesis showed that sustainable consumer behaviour research as a whole can greatly benefit from the interdisciplinary spirit of the circular economy. The intentions-behaviour gap was successfully replicated in the lab by drawing from methods and modelling techniques from both experimental economics and consumer behaviour surveys simultaneously. The experiment offered the critical feature of allowing for the observation of incentive compatible behaviour, while the survey provided the self-reported data necessary to contrast stated preferences and actual behaviour. Additionally, given the freedom of

experimental design, institutional setting could be explicitly considered, and its interactions with psychological factors appraised. The results served to highlight the importance of doing so further, by revealing complex interactions that operate like psychological rebound effects. The results offered support for recent claims that closing the intentions-behaviour gap (IBG) requires looking beyond cognitive processes internal to consumers, as its origin falls primarily beyond the consumer's control (Coffin and Egan–Wyer, 2022). More importantly, the research developed hereby provides a framework for the study of consumer behaviour that explicitly acknowledges this fact. At the same time, rather than discouraging the study of internal cognitive processes, it attributes further value to it. This is done by suggesting that these processes need to be further understood in the context of their conditioning by phenomena that are external to consumers (institutional setting). A focus exclusively on internal cognitive processes in the study of sustainable consumer behaviour (SCB) reflects the notion of disproportionate focus on individual responsibility, characteristic of the 'business as usual' (recycle more, but keep promoting consumerism) narrative that dominates current conceptions of SCB. This Thesis and its results offer a push away from such narratives and toward a more transformative and realistic notion of SCB. In doing so, it paves the way for consumer behaviour and CE research that acknowledges the important role of external factors, and where the potential of consumer psychology (and /or individual responsibility) to influence actual behaviour is not overestimated nor overstated.

APPENDICES

Appendix A: The Armageddon Game – A generalised definition and experimental parametrisation

The Armageddon game (AG) is, at its core, a common pool resource extraction game in which, as the common pool resource deteriorates due to overconsumption, the probability of a catastrophic outcome for agents increases. Agents share access to a common pool resource from which they will have to choose how many tokens, between $\boldsymbol{x_{bot}}$ and $\boldsymbol{x_{top}}$, to extract once every round. Tokens extracted by each agent are collected in their respective private funds. At the end of every round $\boldsymbol{t}$, the common pool contains $\boldsymbol{G_t = G_0 - \sum_{i=1}^{N} x_{i,t}}$ tokens, where $\boldsymbol{x_{i,t}}$ is agent $\boldsymbol{i}$'s extraction from the common pool resource at round $\boldsymbol{t}$, $\boldsymbol{G_0}$ is the size of the common pool resource at the beginning of the game, and $\boldsymbol{N}$ is the number of agents sharing the common pool resource. Then, a probability $\boldsymbol{P_t = f(G_t)}$, is computed such that $\boldsymbol{f}: \mathbb{Z} \rightarrow [\mathbf{0}, \mathbf{1}]$ is a monotonically descending function. In turn, $\boldsymbol{P_t}$ is the probability that the game will end abruptly, and all private funds will be emptied, hence leaving all agents earning nothing. Provided that the game continues onto the next round, the common pool resource regenerates $\boldsymbol{R}$ tokens (fixed across rounds) such that $\boldsymbol{G_{t+1} = G_t + R}$, and the extraction process is repeated once again. In the following paragraphs the game is described using the parametrisation that was employed in the experiment for further clarity. Figure 3 (Chapter 4, p. 123) provides a flow chart of the AG for reference.

In the experiment, a group of 4 players shares a common pool, G, which starts off containing $G_0 = 1300$ tokens. In each round, each player must decide independently on an integer number of tokens between 1 and 18 to consume from the common pool. That is, player i's consumption in tokens from the common pool in round t is $1 \leq x_{i,t} \leq 18 \in \mathbb{Z}$. Each player has a private fund which accumulates their own tokens over all rounds, such that player i's private fund at time t is given by $Y_{i,t} = \sum_t x_{i,t}$. Once all players have decided on their consumption for the round, i.e. at the end of the round, the common pool contains

$$G_{\mathrm{t}} = \min(G_{\mathrm{t-1}} + 20, G_0) - \sum_{\mathrm{i=1}}^{4} \mathrm{x_{i,t}} \qquad \textbf{(Eq.1)}$$

tokens. The first term of Eq.1 means that the common pool has the capacity to recover a maximum of 20 tokens from the end of one round to the start of the next, without ever exceeding its original size $G_0 = 1300$. Then, this starting size of the resource will be reduced by the sum of

all players' extractions that round, as shown by the second term of Eq.1. The reason why this is important, is that G_t will determine a probability of moving onto the next round according to the following expression

$$p_t = \frac{G_t}{G_0} = \frac{G_t}{1300} \qquad \textbf{(Eq.2)}$$

meaning that with probability $1 - p_t$ an Armageddon event will take place. If an Armageddon event takes place at any time during the game, all private funds are emptied, and the game is terminated abruptly for all 4 players of the group (i.e. a catastrophic outcome for everyone). It is essentially the "end of the world". On the other hand, provided an Armageddon event does not take place, the common pool is replenished according to the rule described by Eq.1 and the next decision phase begins. In sum, the AG is a dynamic common pool resource extraction game since players are faced with the decision phase not just once, but once every round. Moreover, it is not just a repeated game since the outcomes of one round will determine the starting conditions for the next.

At the beginning of the game, a round number is chosen at random and unknown to all players (and in the context of the experiment also to the experimentalist), which is called the **final round**. Once a group completes the final round, provided that they move onto the next (i.e. an Armageddon event doesn't take place), the game ends and players keep the contents of their private funds. **Payment 1** is equal to the monetary value of the contents of a player's private fund when the game ends, which is calculated using the exchange rate 10 tokens = 1€. This means that players whose group completes the final round will receive a **Payment 1** given by Eq.3 below

$$Payment\ 1_i = \frac{1}{10}\left(\sum_{t=1}^{T} x_{i,t}\right) € \qquad \textbf{(Eq.3)}$$

where T here is the final round. On the other hand, if a group does not reach and complete the final round, which is any case in which an Armageddon event takes place, all private funds are emptied. Thus, in this case all players would receive a reward of 0€ for **Payment 1**.

By only offering the opportunity to receive any kind of reward through survival over the whole duration of the game, that is **Payment 1**, players would be forced to try to survive until the last round if they wanted any chance at earning anything at all. Therefore, on top of **Payment 1**, a second reward is designed into the game to avoid inducing a bias towards unrealistically forward-looking behaviour. This is achieved by giving each individual extraction a value of its own, which is not dependent upon the survival of the world. At the end of the game, one of the rounds

played by the group is selected at random, this is the **payment round**, τ. A player's extraction in round τ will determine **Payment 2** using the same exchange rate between tokens and euros as shown in Eq.4.

$$Payment\ 2_i = \frac{x_{i,\tau}}{10}\ € \qquad \textbf{(Eq.4)}$$

At the end of the game, the **Total Payoff**, for any given player is given by the sum of payments 1 and 2 for the same player (and, in the experimental setting, the show-up fee of 3.5€ which is paid to all participants regardless of the outcome of the game). Hence,

$$Total\ Payoff_i = Payment\ 1_i + Payment\ 2_i$$
$$= \begin{cases} \frac{1}{10}\left(\sum_{t=1}^{T} x_{i,t}\right) + \frac{x_{i,\tau}}{10}€ & \text{if Armageddon} = FALSE \\ 0 + \frac{x_{i,\tau}}{10}€ & \text{if Armageddon} = TRUE \end{cases} \qquad \textbf{(Eq.5)}$$

so players have an incentive to increase their token consumption per round to increase both the size of their private fund and the return from **Payment 2**. However, they also have an incentive, opposing the first, to reduce their consumption and, in turn, keep the probability of survival large enough, and hence avoid losing their private funds to an Armageddon event.

In the experiment, the final round number is determined at random but confined to lie between 35 and 40, which provides an objectively similar chance of earning a non-zero **Payment 1** to all groups of participants. However, participants are not made aware of the exact interval of possible values for the final round, so that no end-game dynamics are expected. Additionally, in the experimental implementation of the game, another round is chosen at random for each group at the beginning of the game, termed the **Z-Round**, $15 \leq t_z \leq 25$. Up to period t_z, the probability of an Armageddon event taking place is kept at zero. From and beyond round t_z, the probability of an Armageddon event taking place is p_t, as shown in Eq.2. The role of this period is twofold. First, it ensures that all groups play a minimum of 15 rounds, which makes all data collected comparable up to that round. Second, it increases the probability of reaching and completing the final round, very significantly for groups who behave sustainably on average but mildly for groups who do not. Again, the value of t_z is unknown to participants, so they are expected to play as if an Armageddon event was possible at any round. Especially given that, while before t_z the probability of survival is always 1, beyond that, the probability of survival depends on the size of the common pool G_t, which is determined by all previous rounds, regardless of whether they took

place before or after t_z. As such, groups who behave more unsustainably before round t_z, are still almost certain to experience an Armageddon event before reaching the final round.

Appendix B: A utility-theoretical model of the Armageddon game

A utility-theoretical model is developed here to provide a set of benchmark solutions. Namely, the static Nash equilibrium, whereby other payer's behaviour is taken as given and individual profit is maximised, and the static collective optimal strategy, in which collective profit is maximised and cooperation/equal behaviour may be assumed from all agents.

As mentioned previously, static solutions are explored, i.e. solutions where agents are assumed to repeat the same decision in every period, such that an arbitrary player i extracts the same amount, x_i, in all periods. Since two different payments can be obtained by agents (see Section 3), their profit (utility) will comprise a term corresponding to payment 1 and another to payment 2. The former will vary with the world's survival probability and the size of the extraction, which under the assumption of static behaviour remains constant over time. Similarly, the latter term is a fixed x_i (as shown below) since agents are guaranteed to earn exactly one of their extractions during the game. Let us write player i's utility *from* some round t as follows:

$$u_{i,t} = p_t x_i + \frac{1}{T} x_i \qquad \textbf{(Eq.6)}$$

Here, T is the number of rounds played, which will be assumed to be the final round without loss of generality. Since one of the T rounds played is guaranteed to be the payment round and there is an equal probability that any of them will be the payment round, it follows that said probability is 1/T. This is captured in the second term of Eq. 6. On the other hand, the first term relates to payment 1, and is defined as the player's consumption weighted (multiplied) by the probability of survival of the world (i.e. the probability of moving on to the next round, or earning their extractions if the round played is the final one). In other words, survival being more probable increases individual utility and so does a greater individual consumption. However, since said probability decreases as individual extractions increase, there is a sort of trade-off between the two, which leads to the desired social dilemma.

Given the foundations of the AG, a player in a group that does not reach the final round will only receive profit from payment 2. In other words, an Armageddon event taking place ensures that no utility is gained from the accumulated extractions. Under the sole assumption that reaching the final round is more desirable than not under all circumstances[12], the case of reaching

[12] The final round's minimum possible value is 35, and the minimum possible extraction per round is 1 token. Therefore, even when minimising all extractions, reaching the final round will result in a higher utility (i.e. 35+1 tokens) than not reaching it while maximising payment 2 (i.e. 0+18 tokens).

the final round is modelled to find meaningful benchmark solutions. Let us define player i's total utility at the final round as the sum of all local utilities as given by Eq.6 up to the final round:

$$U_{i,T} = \sum_{t=1}^{T} u_{i,t} = x_i \sum_{t=1}^{T} p_t + x_i \qquad \textbf{(Eq.7)}$$

Since static behaviour of all players is the focus, and the common pool regenerates at a constant rate per round of 20 tokens, a group's collective consumption, C, can be sustainable, if $C \leq 20$, or unsustainable, if $C > 20$. This allows us to write the size of the common fund at time t (i.e. Eq.1) as a function of the common pool's original size G_0, rather than as a recurrence relation between a round and the one preceding it. The resulting expression is as follows:

$$G_t = \begin{cases} \mathrm{G}_0 - \left(X_j + \mathrm{x_i}\right) & \text{if } \mathrm{C} \leq 20 \\ \mathrm{G}_0 + 20(t-1) - t\left(X_j + \mathrm{x_i}\right) & \text{if } \mathrm{C} > 20 \end{cases} \qquad \textbf{(Eq.8)}$$

Where $X_j = \sum_{j \neq i}^{4} x_j$ is the sum of other players' consumption at any given round (since behaviour is assumed to be static), such that $X_j + x_i = \sum_{i=1}^{4} x_i$. Therefore, player i's total utility at the final round, i.e. Eq.7, can be written as follows:

$$U_{i,T} = \begin{cases} \mathrm{x_i}\left(\sum_{\mathrm{t=1}}^{\mathrm{T}} \dfrac{\mathrm{G}_0 - \left(X_j + \mathrm{x_i}\right)}{\mathrm{G}_0} + 1\right) & \text{if } \mathrm{C} \leq 20 \\ \mathrm{x_i}\left(\left(\sum_{\mathrm{t=1}}^{\mathrm{T}} \dfrac{\mathrm{G}_0 + 20(t-1) - t\left(X_j + \mathrm{x_i}\right)}{\mathrm{G}_0}\right) + 1\right) & \text{if } \mathrm{C} > 20 \end{cases} \qquad \textbf{(Eq.9)}$$

$$= \begin{cases} \mathrm{x_i}\left(\mathrm{T}\dfrac{\mathrm{G}_0 - \left(X_j + \mathrm{x_i}\right)}{\mathrm{G}_0} + 1\right) & \text{if } \mathrm{C} \leq 20 \\ \mathrm{x_i}\left(T + \dfrac{20}{\mathrm{G}_0}\left(\dfrac{T(T-1)}{2}\right) - \dfrac{T(T+1)}{2\mathrm{G}_0}X_j - \dfrac{T(T+1)}{2\mathrm{G}_0}\mathrm{x_i} + 1\right) & \text{if } \mathrm{C} > 20 \end{cases}$$

Taking the partial derivative of the total utility, $U_{i,T}$, with respect to arbitrary player i's consumption, x_i, gives the following:

$$\frac{\partial U_{i,T}}{\partial \mathrm{x_i}} = \begin{cases} T\left(1 - \dfrac{X_j}{\mathrm{G}_0} - \dfrac{2\mathrm{x_i}}{\mathrm{G}_0}\right) + 1 & \text{if } \mathrm{C} \leq 20 \\ T\left(1 + \dfrac{20(T-1)}{2\mathrm{G}_0} - \dfrac{(T+1)}{2\mathrm{G}_0}X_j - \dfrac{(T+1)}{\mathrm{G}_0}\mathrm{x_i}\right) + 1 & \text{if } \mathrm{C} > 20 \end{cases} \qquad \textbf{(Eq.10)}$$

The *reaction function*, i.e. an expression which defines an arbitrary player's individual utility-maximising consumption decision in term of other people's behaviour, is obtained by setting $\frac{\partial U_{i,T}}{\partial x_i} = 0$ and solving for x_i to give the following:

$$\mathrm{x_i} = \begin{cases} \frac{\mathrm{G_0}}{2} + \frac{\mathrm{G_0}}{2T} - \frac{X_j}{2} & \text{if } \mathrm{C} \leq 20 \\ \frac{\mathrm{G_0}}{(T+1)} + \frac{10(T-1)}{T+1} + \frac{\mathrm{G_0}}{T(T+1)} - \frac{X_j}{2} & \text{if } \mathrm{C} > 20 \end{cases} \quad \textbf{(Eq.11)}$$

Setting $\mathrm{x_{Nash}} = \mathrm{x_i} = \mathrm{x_j}$, $\forall \mathrm{i,j} \in \mathrm{I}$, where $\mathrm{I} = \{1,2,3,4\}$ is the indexing set for players in a group, and solving for $\mathrm{x_{Nash}}$, gives the following static Nash equilibrium:

$$x_{Nash} = \begin{cases} \frac{\mathrm{G_0}(T+1)}{(N+1)} & \text{if } \mathrm{C} \leq 20 \\ \frac{1}{(N+1)}\left(\frac{2\mathrm{G_0}}{T} + \frac{20(T-1)}{T+1}\right) & \text{if } \mathrm{C} > 20 \end{cases} \quad \textbf{(Eq.12)}$$

The static *collective optimal* (CO) strategy is now considered to compute a benchmark solution which may allow for unsustainable but cooperative behaviours. In this case, rather than through its sustainability or lack thereof, cooperation will be operationalised in terms of the group's joint profits. Therefore, let us begin by defining collective profit as the sum of all the individual total utilities, $U_{i,T}$, that is:

$$\Pi_{\mathrm{T}} = \sum_{i=1}^{4} U_{i,T} \quad \textbf{(Eq.13)}$$

Since this pertains to cooperative behaviour, all players may be assumed to split the collective profit in equal parts. In other words, all players may be assumed to consume the same amount, $x_{\mathrm{Co}} = x_i = x_{\mathrm{j}}, \forall i,j \in I$. Therefore, this is written as follows:

$$\begin{aligned} \Pi_{\mathrm{T}} &= \begin{cases} \sum_{\mathrm{i}=1}^{N}\left(\mathrm{x_{Co}}(\mathrm{T}+1) - \frac{\mathrm{NT}}{\mathrm{G_0}}{\mathrm{x_{Co}}}^2\right) & \text{if } \mathrm{C} \leq 20 \\ \sum_{\mathrm{i}=1}^{N}\left(\mathrm{x_{Co}}\left(\mathrm{T} + \frac{20T(T-1)}{2\mathrm{G_0}} - \frac{NT(T+1)}{2\mathrm{G_0}}\mathrm{x_{Co}} + 1\right)\right) & \text{if } \mathrm{C} > 20 \end{cases} \\ &= \begin{cases} \mathrm{N}(\mathrm{T}+1)\mathrm{x_{Co}} - \frac{\mathrm{N}^2\mathrm{T}}{\mathrm{G_0}}{\mathrm{x_{Co}}}^2 & \text{if } \mathrm{C} \leq 20 \\ \mathrm{N}\mathrm{x_{Co}}\left(\mathrm{T} + \frac{20T(T-1)}{2\mathrm{G_0}} - \frac{NT(T+1)}{2\mathrm{G_0}}\mathrm{x_{Co}} + 1\right) & \text{if } \mathrm{C} > 20 \end{cases} \end{aligned} \quad \textbf{(Eq.14)}$$

Finally, by solving $\frac{\partial \Pi_T}{\partial x_{\mathrm{Co}}} = 0$ for x_{Co} it follows that the CO strategy is as follows:

$$\mathrm{x_{Co}} = \begin{cases} \frac{\mathrm{G_0}(T+1)}{2N} & \text{if } \mathrm{C} \leq 20 \\ \frac{1}{2N}\left(\frac{2\mathrm{G_0}}{T} + \frac{20(T-1)}{T+1}\right) & \text{if } \mathrm{C} > 20 \end{cases} \quad \textbf{(Eq.15)}$$

The benchmark solutions

It follows from Eq. 12 and 15 that, both in the case of sustainable and unsustainable group-level consumption, $x_{Co} = \frac{N+1}{2N} x_{Nash}$. Since the factor by which the CO strategy and the Nash equilibrium differ is $\frac{N+1}{2N} < 1 \Rightarrow x_{Co} < x_{Nash}$, the model predicts a tragedy of the commons outcome, whereby the maximisation of individual profit requires a higher consumption, and consequent resource depletion, than would be optimal for the collective. As expected in a common pool resource game where the tragedy of the commons comes into play, the model predicts that these strategies will differ increasingly as the number of players sharing the resource, N, increases. It is worth clarifying at this point that this is only one of many possible behavioural models of the game. Rather than predicting behaviour in the experiment, it aims to serve as a basis for comparison of the observed behaviours with a set of realistic individualistic and cooperative levels of consumption, given the model and its underlying assumptions.

To compute numerical values for x_{Co} and x_{Nash}, Eq. 12 and 15 can be used in accordance with the parametrisation employed in the experiment. Namely, there are four agents per group, $N = 4$, the final round lies between 35 and 40 allowing us to pick a value of $T = 40$, and the starting size of the common pool is $G_0 = 1300$. This parametrisation leads to the following benchmark solutions:

$$x_{Nash} = \begin{cases} 10660 & \text{if } C \leq 20 \\ 17 & \text{if } C > 20 \end{cases} \qquad \textbf{(Eq.16)}$$
$$= 17$$

$$x_{Co} = \begin{cases} 6662.5 & \text{if } C \leq 20 \\ 10.65 & \text{if } C > 20 \end{cases} \qquad \textbf{(Eq.17)}$$
$$= 11$$

Not surprisingly, given the myopic representation of the utility model, even the cooperative solution is over 100% above the sustainable threshold of 5 tokens.

Appendix C: Outliers – detection and analyses

This Appendix addresses the detection of outliers and conducts empirical analysis to inform the decision to keep or remove them from the data. Univariate outliers are first identified by means of z-scoring the variables of interest, their potential and most likely causes are discussed, informing the decision on how to handle them. The same process is then carried out for multivariate outliers.

Univariate outliers

All relevant variables were first z-scored, or standardized. Namely, these include all items recorded for subsequent use in measurement models (even if not used), as well as demographic, behavioural, and other observed data. Values in the resulting variables whose absolute value exceeds 4 are considered to be univariate outliers, given that sample size is well above 80 (Hair Jr et al., 2010). Table 26 shows each of the z-scored variables together with their minima and maxima, allowing for the identification of univariate outliers. The final column in Table 26 reports on all the anonymised participant identifiers (subject ID) of outliers where detected.

No univariate outliers were identified for items in the intentions (internal to the experiment, hereafter INT), intentions (external to the experiment) to consume less (BIRED), dispositions towards sustainable consumption (DSC), and Risk Aversion (RA) scales. The same goes for the majority of items in the psychological distance scale. Interestingly, all items in which univariate outliers were found in the psychological distance scale (6 respondents; 2% of the total sample) were reverse-coded. Precisely, half of the reverse coded items in the psychological distance scale presented univariate outliers, while for non-reverse-coded items this was never the case. This may indicate some degree of correlation between the quality of being reverse-coded and the emergence of more extreme responses, at least within the psychological distance scale. Five univariate outliers (1.7% of the sample) were identified in the intentions (external to the experiment) to behave more sustainably (BISUST) scale. Finally, time-averaged consumption relative to others in the group ("avgrelconsum"), contained 2 univariate outliers.

Having identified the univariate outliers in the data, it remains to assess their potential causes. Five candidates are identified in the literature: (1) errors in data entry, (2) poor question-wording, (3) incorrect coding of missing data, (4) sampling error and (5) legitimate extreme values from the intended population (Tabachnick, Fidell and Ullman, 2013).

In the psychological distance and BISUST items, responses were recorded on 7-point Likert scales which did not involve the entry of numerical values by respondents. Data were then automatically logged onto the data-sheet by the z-Tree software. This significantly reduces the likeliness of data-entry errors, particularly since most outliers were consistently extreme across items of the same and different scales, suggesting a degree of intentionality. For example, respondents 277 and 139 in the psychological distance scale; 25, 60 and 46 in the BISUST scale, and 277 and 60 across both scales; as shown in in Table 26. For the rest of outliers in item variables (subject ID: 1, 124, 245 and 182), items of the same scales were explored for potential inconsistencies (i.e. multivariate outliers). While subject 1 in the BISUST scale, and 245 in the psychological distance scale, exhibit some deviation from the rest of outliers, this does not offer sufficient grounds for concluding that a data entry error was a more likely reason than any other potential explanation. While data used to generate "avgrelconsum" did involve manual numerical data entry from participants, these were constrained between 1 and 18. The variable was constructed as an average of, at least, 15 instances (one per period), meaning that one single error in data entry would bear little to no effect in the final operationalisation of "avgrelconsum". Therefore, errors in data entry are discarded as a likely cause of univariate outliers.

Construct	**Z-scored/Standardized Variable**	**Min**	**Max**	**Subject ID**
Intentions to behave in one's individual self-interest. (INT) –Internal to the experiment	1.1 I would intend to behave so as to leave everyone in the group as well off as possible.*	-1.00	3.78	-
	1.2 I would intend to behave so as to profit as much as possible, without considering other members of the group.	**-1.12**	**2.94**	**-**
	2.1 I would extract as much as possible from the resources.	**-1.27**	**1.88**	**-**
	2.2 I would extract as little as possible from the resources.*	-1.91	1.41	-
	2.3 I would extract as much as others from the resources.*	-1.57	2.23	-
	2.4 I would extract as much as possible from the resources, as long as the probability of the world ending is low enough.	**-1.98**	**1.53**	**-**
	3.1 The most important thing for me would be to benefit as much as possible from the resource.	**-1.41**	**2.16**	**-**
	3.2 The most important thing for me would be that everyone benefits as much as possible from the resource, without leaving anyone in the group worse off than anybody else.*	-1.16	2.90	-

Construct	Z-scored/Standardized Variable	Min	Max	Subject ID
Intentions to consume more sustainably (BISUST) – External to the experiment	**1. I would like to consume products and services in a sustainable way in the future.**	**-5.22**	**0.90**	**139, 277**
	2. I will try to consume products and services in a sustainable way in the future.	**-4.41**	**0.99**	**1, 277**
	3. I will insist on consuming products and services in a sustainable way in the future.	**-3.59**	**1.12**	**-**
Intentions to reduce consumption levels overall (BIRED) – External to the experiment	**1. I would like to consume less in the future.**	**-3.08**	**1.15**	**-**
	2. I will try to consume less in the future.	**-3.14**	**1.17**	**-**
	3. I will insist on consuming less in the future.	-2.83	1.35	-
	4. I am willing to consume less in the future.	**-3.27**	**1.19**	**-**
	5. How likely are you to consume less in the future?	-3.40	1.93	-
Intentions to reduce waste generation (part of BISUST) – External to the experiment	1. I would like to produce less waste in the future.	-5.53	0.73	124, 139, 277
	2. I will try to produce less waste in the future.	-4.59	0.93	139, 277
	3. I will insist on producing less waste in the future.	-4.29	0.99	60, 277
Dispositions towards sustainable consumption (DSC)	**1. It is important to me that the products I use do not harm the environment.**	**-3.62**	**1.27**	**-**
	2. I consider the potential environmental impact of my actions when making many of my decisions.	**-2.73**	**1.23**	**-**
	3. My purchase habits are affected by my concern for our environment.	**-2.33**	**1.56**	**-**
	4. I am concerned about wasting the resources of our planet.	**-3.69**	**1.03**	**-**
	5. I would describe myself as environmentally responsible.	**-3.08**	**1.71**	**-**
	6. I am willing to be inconvenienced in order to take actions that are more environmentally friendly.	**-3.00**	**1.49**	**-**
Risk aversion (SGG task)	**Choice of a lottery L_1** ∈ [(1.00€, 100%), (1.12€, 90%), (1.27€, 80%), (1.47€, 70%), (1.73€, 60%), (2.10€, 50%), (2.65€, 40%), (3.56€, 30%), (5.40€, 20%), (10.90€, 10%)]	**-1.62**	**1.40**	**-**
	Choice of a lottery L_2 ∈ [(1.00€, 100%), (1.20€, 90%), (1.50€, 80%), (1.90€, 70%), (2.30€, 60%), (3.00€, 50%), (4.00€, 40%), (5.70€, 30%), (9.00€, 20%), (19.00€, 10%)]	**-1.72**	**1.59**	**-**
	Choice of a lottery L_3 ∈ [(1.00€, 100%), (1.66€, 90%), (2.50€, 80%), (3.57€, 70%), (5.00€, 60%), (7.00€, 50%), (10.00€, 40%), (15.00€, 30%), (25.00€, 20%), (55.00€, 10%)]	**-1.77**	**1.79**	**-**
	Choice of a lottery L_4 ∈ [(1.00€, 100%), (2.20€, 90%), (3.80€, 80%), (5.70€, 70%),	**-1.53**	**1.92**	**-**

Construct	Z-scored/Standardized Variable	Min	Max	Subject ID
	(8.30€, 60%), (12.00€, 50%), (17.50€, 40%), (26.70€, 30%), (45.00€, 20%), (100.00€, 10%)]			
Psychological distance to climate change (PD)	1. I feel geographically far from the effects of climate change.(Sp)	-1.40	2.44	-
	2. Serious effects of climate change will mostly occur in areas far away from here.(Sp)	-1.15	2.34	-
	3. My local area will be affected by climate change.(Sp)*	-1.04	4.06	25, 245, 277
	4. Climate change will have consequences for every region, including where I live.(Sp)*	-0.80	4.64	25, 60, 277
	5. I don't see myself as someone who will be affected by climate change. (Soc)	**-0.97**	**2.59**	**-**
	6. Serious effects of climate change will mostly affect people who are distant from me. (Soc)	**-1.03**	**2.31**	**-**
	7. My family and I will be safe from the effects of climate change. (Soc)	**-1.02**	**3.09**	**-**
	8. I can identify with victims of climate related disasters. (Soc)*	-1.78	1.88	-
	9. Climate change is happening now.(T)*	-0.71	4.57	25, 46, 60, 182
	10. We will see the serious effects of climate change in my lifetime. (T)*	-0.79	3.80	-
	11. If climate change is to happen, it will happen in the remote future. (T)(H)	-1.20	2.32	-
	12. The region where I live is already experiencing serious effects of climate change. (T)(Sp)*	-1.46	2.58	-
	13. Climate change will not change my life, or my family's lives anytime soon. (T)(Soc)	-1.06	2.67	-
	14. Climate change is virtually certain to affect the world.(H)*	-0.65	5.53	46, 60
	15. It is almost certain that climate change will change my life for the worse. (H)*	-1.09	3.05	-
	16. It is extremely unlikely that climate change will affect me.(H)	-0.94	2.64	-
	17. My local area is very unlikely to be affected by climate change.(H)(Sp)	-1.01	2.14	-
	18. It is virtually certain that my family will be safe from the effects of climate change. (H)(Soc)	**-1.09**	**2.67**	**-**
Non-item variables	"avgrelconsum" – Consumption relative to others' in the group, averaged over all periods engaged.	-1.74	5.32	38, 167
	TimeComp - Time taken to complete the instructions comprehension "test" prior to the experiment	-0.95	8.16	137 (23.1'), 138 (28.04'), 140 (28.51'), 276 (16.35')

Construct	Z-scored/Standardized Variable	Min	Max	Subject ID
	Age (continuous)	-0.88	9.95	121 (48y), 224 (41y), 251 (45y), 283 (69y)
	AgeCat (frequency-based 3-category variable)	-1.51	0.98	
	Gender – Coded as 1 for Female and 0 for Male.	-1.04	0.96	
	Education – Highest level attained.	-1.31	2.07	
	Household composition	-2.78	1.36	
	Household income level	-1.52	2.77	
	Degree of urbanisation	-2.29	1.83	

Table 26. Item, behavioural, demographic and other relevant variables tabulated against their standardised minima and maxima. The 'Construct' column specifies the name of the latent construct that specific items address. For such (item) variables, the item number followed by the underlying questionnaire item are provided in the 'Z-scored/Standardized Variable'. Item variables that were utilised beyond exploratory factor analysis are shown in **bold**. For non-item variables, the variable's name followed by a short description of the variable, is provided. 'Min' and 'Max' show the minima and maxima of the corresponding standardised variable, respectively. Moreover, entries whose absolute value is >4 are shown in red. The 'ID' column states the anonymised participant identifier for univariate outliers in the corresponding variable. In the PD scale, items are marked relative to each of the PD-dimensions they encompass: $^{(Sp)}$ – Space, $^{(T)}$ – Time, $^{(H)}$ – Hypothetical, $^{(Soc)}$ – Social. *-reverse-coded.

Question wording, in particular reverse-coding, could have played a role in the emergence of outliers, at least within the psychological distance scale. For participants 277 and 60, this was unlikely to be the case since they appear as outliers also in the BISUST scale items, which were not reverse-coded and of a different nature. For the other 4 outliers in the psychological distance and the 3 in the BISUST scales, reverse-coding may have played a role in the former, but is not applicable to the latter. The low portion of outliers and their consistency across items of the same scales, together with the fact that items stemmed from previously utilised and validated scales, suggests that question wording had little effect, if any, in the emergence of outliers. In the case of "avgrelconsum", poor question wording is not applicable, since it contains information from several experimental rounds (min. 15) whose dynamics were carefully introduced at the start of the experiment, and detailed instructions were made available to all individuals at all times. Therefore, poor question wording was excluded as a potential explanation for the emergence of outliers.

The controlled laboratory setting and experimental data collection techniques led to no missing data in the dataset. Data were still screened to search for issues of the same nature, and

no coding errors were found. Hence, missing data coding was excluded as a potential cause of emergent outliers.

Uni. Out.	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
AgeCat (1)						
2	0.049	0.054	0.014	-0.041		
3	0.316	0.327	0.263	0.256		
Fem	-0.611	-0.575	-0.582	-0.602	-0.596	0.351
Educ (3)						
6	-0.151	-0.190				
Urb (1)						
2	-0.395	-0.445	-0.415			
3	-0.069	-0.141	-0.138			
Hous (1)						
3	0.458	0.426	0.448	0.452	0.537	
5	-0.023	-0.026	-0.026	-0.068	-0.041	
6	0.385	0.357	0.380	0.388	0.317	
Income (1)						
3	0.565	0.560	0.562	0.574	0.559	0.574
4	0.901	0.887	0.907	0.883	0.795	0.850
5	0.410	0.345	0.373	0.343	0.275	0.281
6	0.736	0.678	0.657	0.679	0.616	0.687
10	1.502	1.590	1.571	1.574	1.527	1.475
Treatment	0.315					
Constant	-2.472	-2.200	-2.269	-2.379	-2.244	-2.149*
LR(χ2)	13.880	13.080	12.780	12.240	11.600	9.340
p-value	0.534	0.520	0.465	0.346	0.237	0.155
Pseudo R2	0.172	0.162	0.159	0.152	0.144	0.116
AIC	98.653	97.455	95.755	92.301	88.937	85.197
BIC	157.645	152.760	147.373	136.545	125.807	111.005

Table 27. Nested probit model coefficient estimates on the outcome variable of *being a univariate outlier*. Categorical explanatory variables are presented with their abbreviated name, and with the reference-category number shown in brackets. Categories in explanatory variables with no variation in the dependent variable were excluded, hence using all 295 available observations in all models. Variables and other rows presented are defined as follows: AgeCat – Categorical age variable. Fem – Gender variable coded as 1 for female and 0 for male. Educ – Highest level of education acquired. Urb – Degree of urbanisation. Hous – Household composition variable distinguishing different quantities of inhabitants and distribution of adults and minors. Income – Household income by categories. Treatment – The experimental treatment variable coded as 1 for uncertainty and 0 for ambiguity. LR(χ2) – Likelihood Ratio Chi Square; Test statistic for the joint null hypothesis that all coefficients in the model are simultaneously equal to zero. P-value – The 95% confidence p-value for the LR(χ2). Pseudo R^2 – McFadden R^2 of the model. AIC – Akaike Information Criterion. BIC - Bayesian Information Criterion.

Finally, it remains to consider whether extreme values in the dataset were caused by sampling errors, i.e. the observation of behaviours and responses that originate from agents that fall outside the population corresponding to the study's focus. While most univariate outliers were male (7 out of 9), data was sampled using quotas for gender to achieve a comparable

representation from both males and females. Therefore, this bears no indication of sampling error. As shown in Table 26, the most potential for this issue lies in the age variable, since it is the only demographic variable with univariate outliers. However, none of the outliers in the age variable matched any of the outliers in the variables of interest, indicating that including much older participants had no relation with the observed outliers. Moreover, a set of probit models (Table 27) on the variable of *being a univariate outlier* did not find significant effects from any of the demographic variables in the dataset, and the joint null hypothesis of all coefficients being zero could not be rejected (min. p-value=0.155; Model 6 in Table 27), in further support of the idea that sampling error was not the issue behind these extreme values, even with respect to age and gender. That is, outliers were of no particular demographic profile to suggest that they can be considered to not belong in the population of interest on that basis. It is therefore concluded that univariate outliers in the data are genuine extreme values from the population of interest and should therefore be handled as such and kept in the data.

None of the item responses were re-coded, winsorised and/or removed based on being univariate outliers. This decision is based on not having a good reason to disregard these responses other than their extremeness, which was limited by the length of the scale and most likely is a realistic representation of the population of interest. No transformation was used in item-variables since this would affect the distance between points in the Likert scale, which was carefully constructed with the intention to achieve equally spaced categories, and could lead to conceptual problems in their interpretation. Finally, the behavioural variable "avgrelconsum" was not transformed as the absolute values of skewness and kurtosis were 1.53 and 4.93 respectively, which according to West, Finch and Curran (1995) (proposed thresholds: |skewness|<2; |kurtosis|<7) shows no sign of serious non-normality issues.

Multivariate outliers

Having inspected univariate outliers, which can offer some indication as to why some variables may be problematic when used for statistical inference, multivariate outliers are now addressed. For each observation (subject), the Mahalanobis distance (Hair Jr et al., 2010) is computed in the multidimensional space spanned by all the item variables measured in the questionnaire, and a behavioural variable. Since extreme responses and behaviours are the focus, and to avoid a self-fulfilling prophecy leading to the conclusion that outliers were due to sampling error, this excludes demographic data. Therefore, for example, someone being much older or much less

educated than the rest will not affect their status as an outlier, provided their responses and behaviours fall within the norm. Next, following Tabachnick, Fidell and Ullman (2013), confidence intervals are computed for each distance and the resulting p-values below the threshold of 0.001 are considered to be multivariate outliers. A total of 20 multivariate outliers (6.8% of the sample) were identified, shown in Table 28. All of the univariate outliers identified above were also multivariate outliers, except for respondent 139.

Subject	Mahalnobis D^2	sqrt(D^2)
1	146.05	**12.09**
25	90.15	9.49
46	95.45	9.77
60	136.09	11.67
93	84.36	9.19
97	86.07	9.28
98	90.18	9.50
104	82.97	9.11
121	115.10	10.73
124	139.57	11.81
179	136.39	11.68
182	114.37	10.69
210	85.62	9.25
214	98.86	9.94
234	85.91	9.27
245	95.69	9.78
277	112.88	10.62
285	112.53	10.61
286	98.43	9.92
289	83.86	9.16

Table 28. Mahalanobis distance, with respect to the multivariate space spanned by all item variables and one behavioural variable, is presented for each of the multivariate outliers. Anonymised participant identifiers are provided in the first column. All p-values for the distances shown in the table were smaller than 0.001 and are therefore considered multivariate outliers. The largest Mahalanobis distance is shown in bold. In total, 20 (6.8% of the total sample) respondents were categorised as multivariate outliers.

Following a similar rationale to that about univariate outliers in the previous subsection, data-entry errors, missing data coding errors are excluded as reasons for outliers in the data. Poor question wording is simply not applicable to multivariate outliers in the same sense as in the univariate case. Since multivariate outliers are outliers with respect to numerous variables at once, there is little that the identification of such outliers can say about the wording of a specific question. Therefore, it remains to determine whether sampling error may have played a role in the emergence of the multivariate outliers that were identified, or extreme responses from the

population of interest are a more likely conclusion. To asses this a number of quasi-nested probit models on the binary outcome of *being a multivariate outlier* were fit, using demographic predictors to understand the profile of outliers and discuss the potential that they are from outside the population of interest. The models also explore the role that participating in one treatment, compared to the other, may have played.

As shown in Table 29, based on Akaike's and Bayesian Information Criteria (AIC and BIC, respectively) models 4 and 6 fitted the data best. This suggests that the age and treatment variables add little information to the models in general. The demographic features that the models identify as significant predictors of extreme responses were household composition ("Hous") and household income (Income) variables. Namely, *ceteris paribus*, belonging in the 4th and 5th categories in "Hous", i.e. *two adults with minors* ("Hous4") and *more than two adults* ("Hous5") respectively, made respondents significantly less likely to exhibit outlier behaviour, when compared to respondents in the (reference) 1st category, i.e. *one person* ("Hous1"). The effect of "Hous4" was conditional upon controlling for income, while the effect of "Hous5" was stronger and always significant. In addition, for respondents in "Hous5", those in the risk treatment were significantly more likely to be outliers than those in the ambiguity treatment. Therefore, in the ambiguity treatment, belonging in "Hous1" is more strongly associated with being an outlier than in the uncertainty case[13]. Moreover, all the models in which household income was controlled for, everything else being equal, belonging to the 5th category ("Income5") predicted increased probability of being an outlier, when compared to the 1st.

In sum, the models suggest that outlier responses emerged due to a combination of, and interaction between, a given demographic profile and some conditioning emanating from a certain experimental treatment. Rather than a sampling error, this is considered a realistic representation of how a certain profile of consumer – relevant to the focus of this research – is affected by the quality of information, or ambiguity vs. risk, available in their consumption context. Since differences in quality of information are a feature that is very present in a real consumption context, any conditioning that may have taken place is considered a realistic

[13] The models find that treatment moderated the effect of the Hous5 variable on being a multivariate outlier. On one hand, belonging in the Hous1 category predicted significantly higher chances of being an outlier, relative to Hous5. Conversely, being in Hous5 and the uncertainty treatment predicted higher chances of being an outlier than being in Hous5 and the ambiguity treatment. Therefore, the difference between belonging in Hous1 and Hous5, relative to the likeliness of being an outlier, is larger in the ambiguity treatment. Since, by definition, any conditioning is expected to lead to extremes (rather than to attenuate otherwise existent extreme behaviours) the only possible interpretation is that the ambiguity treatment led respondents in the Hous1 to exhibit more outlier behaviours/responses relative to those in Hous5, than in the other treatment.

representation of how certain consumers may react to the availability of more or less information in the behavioural situation of interest.

Therefore, sampling error was discarded as a potential cause of the identified multivariate outliers. As such, subsequent analysis considers them true outliers from the population of interest, while still acknowledging that this may either inflate or underestimate some parameter estimates (Coin, 2008; Mowbray, Fox-Wasylyshyn and El-Masri, 2019) This will be addressed by using robust estimation methods whenever possible, and running structural equation models under both the assumption of ordinal items (WLSMV) and continuous scale items (ML).

Multi. Out	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**
AgeCat (1)								
2	-0.364	-0.423	-0.351	-0.404	-0.350		-0.312	
3	-0.254	-0.231	-0.093	-0.275	-0.084		-0.058	
Fem	-0.418	-0.398	-0.372	-0.345	-0.375	-0.386	-0.370	-0.382
Educ (3)								
5	0.157	0.153						
6	0.386	0.386						
Urb (1)								
2	-0.601							
3	-0.004							
4	-0.505							
Hous (1)								
2	-0.723	-0.634	-0.673	-0.410	-0.722	-0.745	-0.849	-0.696
3	-0.796	-0.873	-0.926	-0.637	-0.925	-0.922	-0.935	-0.926
4	-1.276	-1.263*	-1.343*	-1.066	-1.349*	-1.431*	-1.361*	-1.419*
5	-2.043**	-1.981**	-1.971**	-1.681**	-1.869**	-1.862**	-1.016*	-1.967**
6	-0.816	-0.711	-0.772	-0.562	-0.770	-0.766	-0.771	-0.762
Income (1)								
2	0.791	0.664	0.670		0.679	0.638	0.686	0.629
3	0.760	0.762	0.736		0.767	0.711	0.845	0.681
4	1.168	1.099	1.084		1.105	1.055	1.149	1.036
5	1.251*	1.200*	1.208*		1.235*	1.219*	1.213*	1.197*
6	0.546	0.555	0.586		0.638	0.586	0.778	0.540
8	0.763	0.732	0.725		0.742	0.733	0.753	0.718
10	1.254	1.308	1.323		1.324	1.382	1.380	1.384
HousXTreat. (5 0)								
5 1	1.617*	1.567*	1.460*	1.391*	1.269**	1.241**		1.437*
Treatment	-0.215	-0.210	-0.192	-0.198			0.488	-0.196
Constant	-1.071	-1.180	-1.000	-0.307	-1.129	-1.207*	-1.472*	-1.082
LR(χ2)	30.920	27.920	26.110	19.130	25.830	24.730	19.200	25.020
p-value	0.098	0.085	0.073	**0.039**	0.056	**0.037**	0.258	**0.050**
Pseudo R2	0.211	0.191	0.179	0.131	0.177	0.169	0.131	0.171
AIC	161.343	158.340	156.154	**149.135**	154.429	**151.530**	161.057	153.238
BIC	246.143	232.079	222.519	**189.691**	217.108	**206.835**	223.736	212.229

Table 29. Nested probit model coefficient estimates on the outcome variable of *being a multivariate outlier*. Categorical explanatory variables are presented with their abbreviated name, and with the reference-category number shown in brackets. hence using all 295 available observations in all models Variables and other rows presented are defined as follows: AgeCat – Categorical age variable. Fem – Gender variable coded as 1 for female and 0 for male. Educ – Highest level of education acquired. Urb – Degree of urbanisation. Hous – Household composition variable distinguishing different quantities of inhabitants and distribution of adults and minors. Income – Household income by categories. Treatment – The experimental treatment variable coded as 1 for uncertainty and 0 for ambiguity. HousXTreat. – Interaction term between category 5 of Hous, and Treatment. LR(χ2) – Likelihood Ratio Chi Square; Test statistic for the joint null hypothesis that all coefficients in the model are simultaneously equal to zero. P-value – The 95% confidence p-value for the LR(χ2). Pseudo R^2 – McFadden R^2 of the model. AIC – Akaike Information Criterion. BIC - Bayesian Information Criterion.

Appendix D: Exploratory factor analysis – supplementary materials

This Appendix complements the discussion provided in Chapter 5 (p. 128) about exploratory factor analysis (EFA) of the factors included in the measurement model. Risk aversion (RA) items were also included as an indication of their convergence in support of their subsequent aggregation into a mean. All sets of were first tested for sampling adequacy using Kaiser-Meyer-Olkin's MSA (measure of sampling adequacy), and sphericity using Bartlett's test (Hair Jr et al., 2010). The lowest sampling adequacy score was 0.75 and corresponded to the exploratory scale of concrete intentions, i.e. intentions to behave selfishly within the experiment. Sphericity tests rejected the null hypothesis that the correlation matrix is the identity matrix. As shown in Table 30 below, all scales presented good signs of factorability.

Construct(s)	MSA	Bartlett	Factorability
Intentions (internal)	0.75	Significant	Supported (>0.7: middling)
Intentions (external)	0.89	Significant	Supported (>0.8: meritorious)
Psychological Distance	0.91	Significant	Supported (>0.8: meritorious)
Dispositions toward Sustainable Consumption	0.88	Significant	Supported (>0.8: meritorious)
Risk Aversion	0.76	Significant	Supported (>0.7: middling)

Table 30. Testing for factorability of the measurement items. 'Construct' – The construct to which the items correspond. 'MSA' – measure of sampling adequacy. 'Bartlett' – Bartlett's test of sphericity where *significant* corresponds to p-value<0.001. 'Factorability' – A statement of whether factorability of the items was supported, in brackets are the classification for each set of items, according to Hair Jr et al.'s (2010) guidelines.

The thresholds used to determine the appropriateness of items during EFA was adapted for exploratory vs. adapted or validated scales, and for sample size (Hair Jr et al., 2010). The values are based on recommendations from literature that were covered in more detail in Section 5.2.3 (Child, 2006; Hair Jr et al., 2010; Tabachnick, Fidell and Ullman, 2013; Costello and Osborne, 2019). The rules are summarised in Table 31 below. For all scales, a parallel analysis with 500 iteration simulations was used to determine the number of factors that should be included. Each scale's EFA process is presented in the following sections.

Indicator	Type of instrument	Threshold
Factor loadings	Exploratory	>0.50
	Adapted or validated	>0.70
Communalities	Exploratory	>0.30

Indicator	Type of instrument	Threshold
	Adapted or validated	>0.45

Table 31. Thresholds used in EFA. Factor loadings and communalities are shown together with the thresholds that were employed to determine inclusion and exclusion of measurement items.

Psychological distance (PD)

The parallel analysis and scree plot shown in Figure 6 below suggests that three factors should be retained relative to the simulation. However, the third factor has eigenvalue <1 therefore its appropriateness is not clear. This already indicates some deviation from what was expected. PD has 4 dimensions conceptually which are captured by its 18 items (and some items are included at the intersection between these dimensions). Therefore, if more than one, a reasonable expectation is to obtain a 4-factor structure (4 unidimensional factors that underly a four dimensional overarching PD). The early parallel analysis already points to another reality.

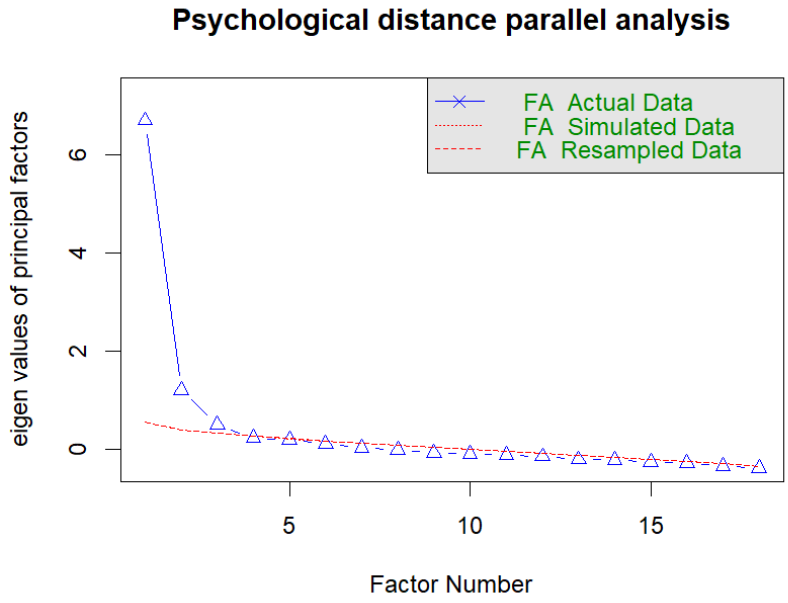


Figure 6. Parallel analysis and scree plot using all 18 psychological distance items.

The 3-factor structure is shown in Table 32. The same factor analysis retaining only two factors had qualitatively similar results, so these are discussed relative to the solution retaining three factors. In the table, values that are above or round up to their corresponding proposed thresholds (see Table 31) are marked in bold. Factor loadings smaller than 0.3 are not shown. Most communalities were satisfactory and above the 0.45 threshold. Factor loadings were not all successful in overcoming the 0.7 mark, but factors 1 and 3 both have at least three satisfactory items. However, the second factor has no items that load significantly enough on it with the

largest factor loading being 0.58. Given that the expectation was a unidimensional scale, and the third factor has an eigenvalue smaller than 1, the factor model is likely to collapse into a unidimensional one after problematic items are identified and removed. The most problematic item has a negligible communality and no factor loadings greater than 0.3, therefore this was removed.

3-factor, 18-items					*1-factor, 6-items*		
Item	*f1*	*f2*	*f3*	*Comm.*	*Item*	*f1*	*Comm.*
pd1	**0.65**			**0.50**			
pd2	**0.84**			**0.65**	pd2	**0.68**	**0.47**
pd3	0.47	0.55		**0.65**			
pd4	0.38	0.57		**0.75**			
pd5	0.49		0.35	**0.61**	pd5	**0.76**	**0.58**
pd6	**0.69**			**0.69**	pd6	**0.81**	**0.66**
pd7	0.53		0.47	**0.79**	pd7	**0.91**	**0.82**
pd8				0.08			
pd9		0.57	0.36	**0.61**			
pd10		0.52	0.44	**0.64**			
pd11			0.33	0.31			
pd12		0.55		0.42			
pd13			0.57	**0.60**			
pd14		0.58	0.43	**0.63**			
pd15		0.41	0.46	**0.47**			
pd16			**0.88**	**0.75**	pd16	**0.73**	**0.54**
pd17			**0.67**	**0.45**			
pd18			**0.70**	**0.73**	pd18	**0.84**	**0.70**

Table 32. Factor analysis of psychological distance items. Left – 18-item 3-factor solution. Right – 6-item 1-factor solution. Each item is shown together with its factor loading on each factor and the communality. All factor loadings shown were statistically significant and values lower than 0.3 were omitted. Empty white cells correspond to factor loadings less than 0.3, while grey cells are not applicable due to the items not being included in the EFA in which they appear. In bold are values that satisfy the standards defined by the thresholds presented in Table 31, or that would satisfy them if rounding to one decimal place. A highly problematic item is shown in red.

Removal of this item did not solve the issue alone, and after subsequent iterations and exploration, items 1, 3, 4, 8-15, and 17 were also removed. This included all reverse-coded items which performed consistently worse, and many of the items that fell in the intersection of two dimensions. Table 33 shows the items where reverse coded items are marked with "*" and each of the dimensions of PD that corresponds to an item is depicted as follows: $^{(Sp)}$ – Space, $^{(T)}$ – Time, $^{(H)}$ – Hypothetical, $^{(Soc)}$ – Social. At this point parallel analysis showed that at most the data suggested a 2-factor structure, with the second factor exceeding the simulated eigenvalue by a

small margin, and still being well below 1. Therefore, from this point further a single factor was retained. The resulting EFA model is shown in Table 32 (to the right of the 3-factor solution). The unidimensional solution shown in Table 32 meets close to all the standards that were set (Table 31). Only item 'pd2' has a factor loading lower than 0.7, suggesting that its removal should be explored. Doing so resulted in a satisfactory EFA model (shown in Table 34) that showed good signs of unidimensionality based on the thresholds used here (Table 31).

However, content validity of the scale could be in question. As shown in Table 33 below, the remaining items (shown in bold) correspond primarily to the social dimension of PD. Based on content validity of the scale, the items unrelated to the social dimension was removed, resulting in a solution that comfortably met the thresholds for factor loadings and communality. Therefore, this solution was retained to maximise content validity of the resulting scale, while ensuring that initial standards of unidimensionality are thoroughly met.

1. I feel geographically far from the effects of climate change.(Sp)
2. Serious effects of climate change will mostly occur in areas far away from here.(Sp)
3. My local area will be affected by climate change.(Sp)*
4. Climate change will have consequences for every region, including where I live.(Sp)*
5. I don't see myself as someone who will be affected by climate change. (Soc)
6. Serious effects of climate change will mostly affect people who are distant from me. (Soc)
7. My family and I will be safe from the effects of climate change. (Soc)
8. I can identify with victims of climate related disasters. (Soc)*
9. Climate change is happening now.(T)*
10. We will see the serious effects of climate change in my lifetime. (T)*
11. If climate change is to happen, it will happen in the remote future. (T)(H)
12. The region where I live is already experiencing serious effects of climate change. (T)(Sp)*
13. Climate change will not change my life, or my family's lives anytime soon. (T)(Soc)
14. Climate change is virtually certain to affect the world.(H)*
15. It is almost certain that climate change will change my life for the worse. (H)*
16. It is extremely unlikely that climate change will affect me.(H)
17. My local area is very unlikely to be affected by climate change.(H)(Sp)
18. It is virtually certain that my family will be safe from the effects of climate change. (H)(Soc)

Table 33. Psychological distance questionnaire items. Items are marked relative to each of the PD-dimensions they relate to: (Sp) – Space, (T) – Time, (H) – Hypothetical, (Soc) – Social. *-reverse-coded. Items shown in bold correspond to those retained in the 1-factor solution of Table 32.

1-factor, 5-items			*1-factor, 4-items*		
Item	*f1*	*Comm.*	*Item*	*f1*	*Comm.*
pd5	**0.76**	**0.58**	pd5	**0.76**	**0.58**
pd6	**0.77**	**0.60**	pd6	**0.78**	**0.60**
pd7	**0.91**	**0.84**	pd7	**0.95**	**0.90**
pd16	**0.75**	**0.56**			
pd18	**0.85**	**0.72**	pd18	**0.80**	**0.64**

Table 34. Factor analysis of psychological distance items. Left – 5-item 1-factor solution. Right – 4-item 1-factor solution. Each item is shown together with its factor loading on each factor and the communality. All factor loadings shown were statistically significant. Grey cells are not applicable due to the items not being included in the EFA in which they appear. Values that surpass the thresholds for factor loadings and communalities reported in Table 31 are marked in bold.

Internal intentions (INT)

Parallel analysis (Figure 7) suggested that 3 factors be retained when considering all 8 items originally developed to capture intentions internal to the experimental context. The scree plot shows that the second factor has an eigenvalue already below 1 and the third factor is even lower and only marginally above the simulated data. The results of these two factor structures had similar implications for the items involved, therefore, the 3-item solution is reported here, in Table 35 for reference. Since the INT factor was built on an exploratory basis, as shown in Table 31, the thresholds for communalities and factor loadings were relaxed accordingly. Values satisfying these are shown in bold in Table 35.

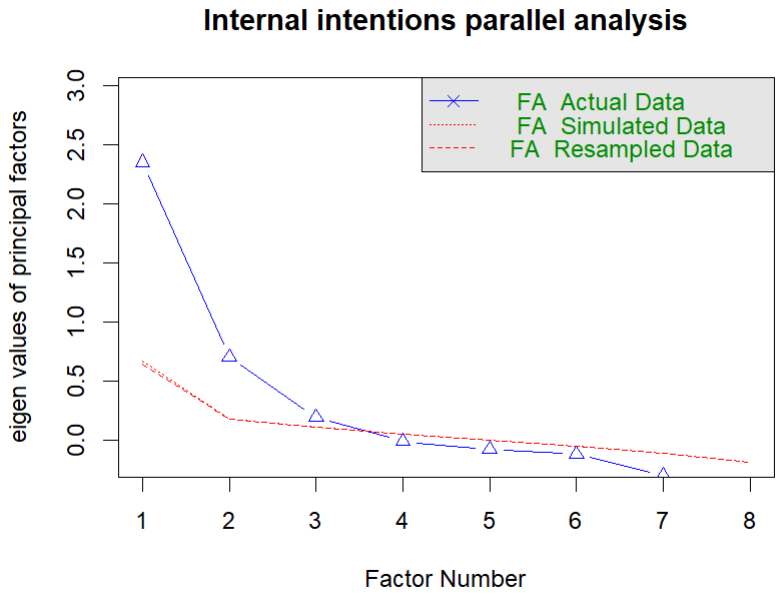


Figure 7. Parallel analysis and scree plot using all 8 internal intentions items.

From here, based on low communality, item 'int5' was removed. However, running the EFA with the new set of items and retaining three factors results in Hayewood cases which suggest potential issues with model specification. Parallel analysis on the new set of items showed a reduction in eigenvalue for both factors beyond the first one, and a smaller margin relative to the simulation than was obtained originally. As a result, in subsequent iterations only one factor is

retained, which results in the removal of item ‘int 8’ due to low communality and factor loading (below 0.1 and 0.3 respectively). The resulting iteration is reported in Table 35, to the right of the first iteration.

3-factor, 8-items					*1-factor, 6-items*		
Item	*f1*	*f2*	*f3*	*Comm.*	*Item*	*f1*	*Comm.*
int1	**0.64**			**0.55**	int1	**0.51**	0.26
int2	**0.75**			**0.71**	int2	**0.72**	**0.52**
int3		**0.99**		**0.98**	int3	**0.81**	**0.65**
int4		**0.65**		**0.52**	int4	**0.75**	**0.57**
int5			**0.51**	0.26			
int6	0.38			**0.31**	int6	**0.54**	0.29
int7	0.46	0.32		**0.43**	int7	**0.61**	**0.38**
int8			**0.76**	**0.66**			

Table 35. Factor analysis of internal intentions (INT) items. Left – 8-item 3-factor solution. Right – 6-item 1-factor solution. Each item is shown together with its factor loading on each factor and the communality. All factor loadings shown were statistically significant and values lower than 0.3 were omitted. Empty white cells correspond to factor loadings less than 0.3, while grey cells are not applicable due to the items not being included in the EFA in which they appear. In bold are values that satisfy the standards defined by the thresholds presented in Table 31.

As shown in Table 35, ‘int1’ had a communality lower than required. Therefore, this item was removed and subsequently, ‘int3’ was removed to maintain consistency in the content of the scale. Namely, this was the only remaining reverse-coded item (relative to other remaining items) and conceptually overlapping significantly with ‘int2’ since they represent the same question but reverse-framed (see Appendix C, Table 26). On the other hand, ‘int6’ offers a disambiguation of ‘int2’ by adding context to the same consideration, which is more in line with the concept of concrete (and implementation) intentions. Therefore, on the grounds of content validity, ‘int2’ was removed and ‘int6’ was retained. Admittedly, in terms of communalities and factor loadings ‘int2’ may have ‘done better’, but inferring this only from the data is not good practice when theoretical reasons, like content of the scale, can be identified. Once this structure has been reached, further parallel analysis indicates that a single factor structure is appropriate, as expected. The resulting model is a 4-item scale that meets the criteria for unidimensionality that were adopted for exploratory scales (Table 31). The resulting EFA model is shown in Table 36 below.

Item	f1	Comm.

int2	**0.68**	**0.46**
int3	**0.69**	**0.47**
int6	**0.59**	**0.35**
int7	**0.71**	**0.50**

Table 36. Factor analysis of internal intentions (INT) items. 4-item 1-factor solution of EFA analysis. Each item is shown together with its factor loading on each factor and the communality. All factor loadings shown were statistically significant. In bold are values that satisfy the standards defined by the thresholds presented in Table 31.

External intentions (BISUST and BIRED)

Given that items relating to external intentions come from the adaptation of the same items to different contexts, the items are considered together in order to explore the possibility that the two concepts overlap. Parallel analysis, shown in Figure 8, suggests a 2-factor structure, with the second factor's eigenvalue close to 1 and significant margin above the simulated data. This is a first indication in support of the expected structure.

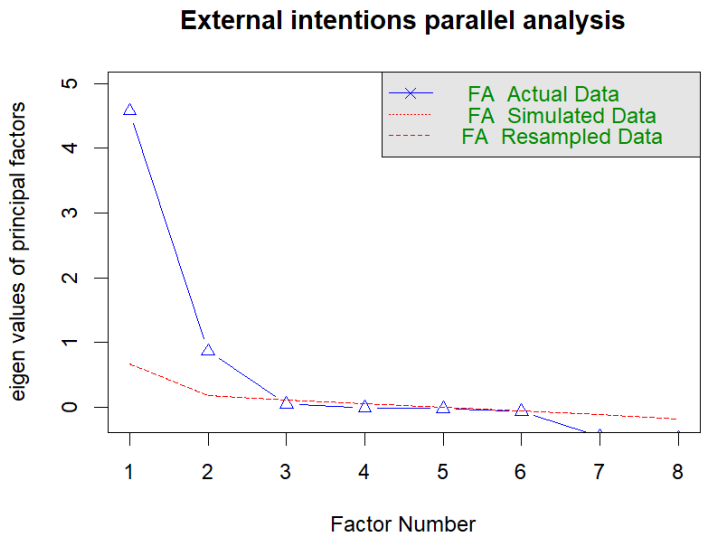


Figure 8. Parallel analysis and scree plot using all 8 available external intentions items (both BISUST and BIRED items).

The first iteration contained only one problematic item ('bired5'), with a factor loading of less than 0.7, which was removed. In the resulting configuration all items met unidimensionality criteria. However, upon further inspection a further item was removed 'bired3' since it significantly improved model fit, both when removed and when compared to the removal of the next item with lowest loading and communality 'bired4' (Including one versus the other had a chi-

square difference of 38.7-7.4=31.3, and including both vs removing the one in question had a chi-square difference of 22.6-7.4=15.2). In both cases, the model went form a significant chi square statistic to a non-significant one. Given that individual items still more than comfortably met the criteria for unidimensionality being employed on all cases analysed, and the significant improvement in fit, the final iteration was retained. The two final iterations are shown in Table 37 below. The resulting EFA model serves not only as support of the unidimensionality of BISUST and BIRED, but also shows early signs of discriminant validity of the scales.

(Chi-square=22.6, p-value=0.004)				*(Chi-square=7.4, p-value=0.116)*			
Item	*BISUST*	*BIRED*	*Comm.*	*Item*	*BISUST*	*BIRED*	*Comm.*
bisust1	**0.90**		**0.78**	bisust1	**0.89**		**0.78**
bisust2	**0.94**		**0.90**	bisust2	**0.93**		**0.90**
bisust3	**0.91**		**0.83**	bisust3	**0.92**		**0.83**
bired1		**0.93**	**0.84**	bired1		**0.92**	**0.84**
bired2		**0.96**	**0.89**	bired2		**0.95**	**0.88**
bired3		**0.88**	**0.84**				
bired4		**0.82**	**0.72**	bired4		**0.81**	**0.72**

Table 37. Factor analysis of external intentions (BISUST and BIRED) items. Left – 7-item 2-factor solution. Right – 6-item 2-factor solution. Each item is shown together with its factor loading on each factor and the communality. All factor loadings shown were statistically significant and values lower than 0.3 were omitted. Empty white cells correspond to factor loadings less than 0.3, while grey cells are not applicable due to the items not being included in the EFA in which they appear. In bold are values that satisfy the standards defined by the thresholds presented in Table 31.

Dispositions toward sustainable consumption (DSC)

Parallel analysis of the 6 DSC items suggested the expected unidimensional factor structure (Figure 9). The EFA confirmed this without further need for refinement of the scale since it showed good signs of unidimensionality all round. The factor loadings and communalities are shown in Table 38.

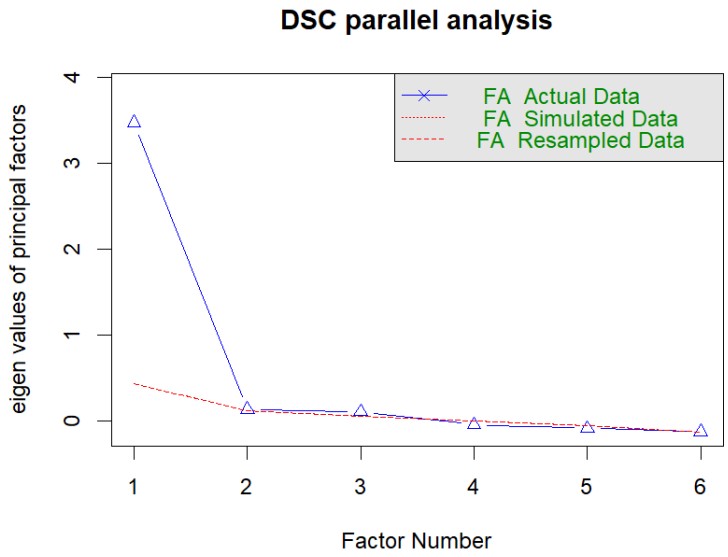


Figure 9. Parallel analysis and scree plot using all 6 DSC items.

Item	*f1*	*Comm.*
green1	**0.80**	**0.64**
green2	**0.83**	**0.68**
green3	**0.83**	**0.69**
green4	**0.76**	**0.57**
green5	**0.75**	**0.56**
green6	**0.75**	**0.56**

Table 38. Factor analysis of dispositions toward sustainable consumption (DSC) items. 6-item 1-factor solution of EFA analysis. Each item is shown together with its factor loading on each factor and the communality. All factor loadings shown were statistically significant. In bold are values that satisfy the standards defined by the thresholds presented in Table 31.

Appendix E: Experimental instructions

Risk treatment (Spanish)

Instrucciones del experimento

Introducción

Esta investigación está financiada por la Comisión Europea.

Este es un experimento sobre toma de decisiones. Tus ganancias dependerán no solo de tus decisiones, sino de las decisiones de los demás, y del azar. Por favor, presta atención a las instrucciones ya que una cantidad considerable de dinero está en juego. La duración estimada de este experimento es dos horas.

Al comienzo de la sesión, serás emparejado aleatoriamente con otros 3 participantes. Por tanto, la sala se dividirá en grupos de 4 participantes. Los grupos son independientes entre sí, es decir, cada grupo formará un mundo distinto, independiente de todos los demás grupos.

Al final de la sesión, recibirás tu pago de forma independiente y privada. En estas instrucciones se detalla cómo tomarás decisiones y de qué va a depender tu pago final. Durante el experimento, las ganancias y los pagos se expresarán en *fichas* experimentales, que serán convertidas a euros al final, utilizando el siguiente tipo de cambio: 10 Fichas = 1€. Además, recibirás 3,5€ como tasa de participación (simplemente por llegar puntualmente y participar en el experimento).

Sobre tu toma de decisiones

El experimento se desarrollará en varias rondas, a lo largo de las cuales deberás tomar decisiones de un mismo tipo. Solo las condiciones iniciales pueden cambiar de una ronda a otra, y éstas serán determinadas por las decisiones individuales tomadas por todos los miembros de tu grupo en las rondas pasadas. En los próximos párrafos se describen en más detalle las posibles decisiones, condiciones iniciales y consecuencias.

Al comienzo de cada ronda, se te pedirá que decidas el número de fichas *N* que deseas extraer de un fondo común *G*, que es compartido entre todos los miembros de tu grupo y comenzará con su capacidad máxima de 1300 fichas. El número de fichas a extraer deberá ser un número entero (es decir, sin decimales) entre 1 y 18. Se te mostrará en pantalla la cantidad de

fichas disponibles en *G* para tomar dicha decisión. Al resto de componentes de tu grupo se les pedirá que tomen decisiones del mismo tipo. Una vez todos los miembros del grupo hayan decidido cuántas fichas extraer de *G* esa ronda, las fichas que hayas extraído serán transferidas a tu fondo privado *F*, procediendo del mismo modo para cada miembro del grupo, y dejando *G* con las fichas restantes (es decir, las fichas no extraídas por tu grupo). A continuación, un parámetro *P* se calculará para tu grupo en esta ronda, que representará un porcentaje (0-100%), que dependerá del número de fichas que queden en *G*, de tal forma que cuanto menor sea el contenido de *G*, mayor será *P*.

Al final de cada ronda, se te mostrará una pantalla con tu extracción individual, la extraccion colectiva de tu grupo, los contenidos de *G* y *F*, y el parámetro *P*, para esa ronda. Además, a partir de la segunda ronda también se te mostrará el histórico de todos los parámetros mencionados anteriormente, para todas las rondas pasadas. A partir de una ronda *Z*, que será determinada aleatoriamente al comienzo del experimento, el parámetro *P* será la probabilidad de que suceda un evento de "Armagedón" (o "fin del mundo"), que resultaría en la terminación precoz y abrupta del experimento. Ni los participantes del experimento ni los investigadores podrán saber cuál será la ronda *Z* durante la sesión. Si un evento de "Armagedón" tiene lugar antes del comienzo de la siguiente ronda, el mundo acabará y el experimento finalizará abruptamente, vaciando así los fondos privados *F* de todos los miembros del grupo (incluido tú). En resumen, hasta la ronda *Z*, la probabilidad de que un evento de "Armagedón" interrumpa el curso natural del experimento será distinta a *P* (e igual a 0%) y, a partir de la ronda *Z*, dicha probabilidad pasará a ser igual al parámetro *P*.

Asumiendo que el experimento continúe la ronda siguiente, 20 fichas serán añadidas a *G*. En otras palabras, *G* se regenera a una velocidad constante de 20 fichas por ronda. Es decir, al principio de la siguiente ronda, *G* contendrá las fichas sobrantes de la ronda anterior más 20 fichas extra. Sin embargo, *G* jamás puede superar su capacidad máxima, que es de 1300 fichas. Por lo tanto, en las rondas en las que la extracción colectiva de tu grupo deje *G* con una deficiencia de fichas menor que 20, la siguiente ronda simplemente comenzará con un *G* en su máximo de capacidad (ya que sumar 20 fichas implicaría exceder la capacidad máxima de *G*).

Una vez determinado el nuevo contenido en fichas de *G*, comenzará la ronda siguiente. De nuevo, se te mostrará el número de fichas en *G* y deberás decidir cuántas extraer en esa ronda. El proceso descrito anteriormente será repetido tantas veces como rondas dure el experimento, acumulando tus extracciones individuales de cada ronda en *F* hasta que suceda una de dos: que

tu grupo llegue a la ronda final, en la que finalizaría el experimento, o que suceda un evento de Armagedón, que además de terminar el experimento vaciaría todos los fondos privados.

Pagos y ganancias totales

Tus ganancias en el experimento serán determinadas como la suma de dos tipos de pago:

Pago 1: De todas las rondas jugadas y para cada grupo, el ordenador seleccionará aleatoriamente una, la **ronda de pago**. Tu extracción de fichas en dicha ronda será convertida a euros utilizando el tipo de cambio especificado al principio de estas instrucciones. En la pantalla final del experimento se mostrarán tu ronda de pago, tu extracción individual en esa misma ronda y el pago correspondiente en euros.

Pago 2: Al principio de la sesión, el ordenador habrá seleccionado al azar un número de ronda para cada grupo. Esto definirá lo que llamamos la *ronda final* y será desconocida para ti. Si tu grupo llega a la ronda final, recibirás lo equivalente a lo contenido en tu fondo privado, en euros. Tu fondo privado habrá acumulado todas tus extracciones a lo largo del experimento, desde la ronda 1 hasta la final. Sin embargo, si ocurre un evento de "Armagedón" antes de la ronda final, todos los fondos privados de tu grupo se vaciarán, el experimento terminará abruptamente y el Pago 2 será, por tanto, igual a 0€. La pantalla final mostrará los contenidos de tu fondo privado cuando acabe el experimento, así como el correspondiente pago (Pago 2).

Tus ganancias totales para este experimento serán:

$$\text{Total} = \text{Pago 1} + \text{Pago 2} + 3{,}5€$$

donde 3,5€ es la tasa de participación.

Finalmente, durante la sesión puede ser que se te pida adivinar la extracción individual media de los demás miembros de tu grupo en la siguiente ronda. Dependiendo de la precisión de tu respuesta con respecto al valor real, podrás ganar un pago extra máximo de 0,5€ por estimación.

Reglas

El uso de la calculadora no está permitido en este experimento. Además, no se puede escribir nada en ninguna parte ni tomar ningún tipo de apunte durante el experimento (a no ser que el equipo técnico del laboratorio te indique lo contrario en algún momento como, por ejemplo, al rellenar el recibo de pago).

Tu participación en el experimento y cualquier información sobre tus ganancias serán mantenidas estrictamente confidenciales. Los únicos lugares donde se encontrará tu nombre son tu recibo de pago, tu formulario de participante y la base de datos del laboratorio. En ningún momento se te pedirá que descubras tu identidad a nadie durante la sesión. Ni los investigadores ni los demás participantes podrán asociarte a ti personalmente con ninguna de tus decisiones. Por favor, para asegurar la privacidad de tus decisiones, no las comuniques a ningún otro participante.

Por favor, no hables con nadie durante el experimento. Rogamos a todos que por favor se mantengan en silencio hasta la ultima ronda y, lo que es más, hasta que todos hayan salido del laboratorio. Si no tienes preguntas, estás listo/a para comenzar. Si tienes alguna duda y/o requieres de algún otro tipo de asistencia en cualquier momento, por favor levanta la mano y te atenderemos lo antes posible de forma privada.

Glosario de conceptos importantes y vocabulario

Fondo común (*G*): El fondo común es compartido únicamente entre miembros del mismo grupo. No puede contener más fichas que con las que empieza, es decir, no se puede llenar mas allá de su capacidad máxima. El experimento empieza con el fondo común lleno al máximo de su capacidad. La cantidad de fichas en el fondo común al final de una ronda determinará el parámetro *P*, de tal forma que cuanto más vacío esté el fondo común, mayor será *P*. A su vez, el parámetro *P* será la probabilidad de que ocurra un evento de Armagedón a partir de una ronda *Z*, que habrá sido seleccionada de manera aleatoria por el ordenador al comienzo de la sesión.

Fondo privado (*F*): Tu fondo privado es solo tuyo, no se comparte con nadie. En él se acumulan todas tus extracciones individuales del fondo común a lo largo de todas las rondas jugadas en el experimento. En el caso de un evento de Armagedón, todos los fondos privados del grupo serán vaciados, dejando el Pago 2 = 0€.

Extracción (*N*): Cada participante elige el número de fichas a extraer del fondo común una vez por ronda. Llamamos extracciones individuales a las decisiones de cada participante en una ronda dada. Llamamos extracción colectiva a la suma de todas las extracciones individuales del mismo grupo y ronda. La suma de todas tus extracciones individuales será almacenada en tu fondo privado *F*. Las extracciones solo pueden ser números enteros.

Evento de Armagedón: Un evento de Armagedón ocurrirá con probabilidad 0% hasta la ronda *Z*, que habrá sido determinada aleatoriamente al principio del experimento y será

desconocida. A partir de dicha ronda, esa probabilidad pasará a ser el parámetro *P*. Si ocurre un evento de Armagedón, todos los participantes de tu grupo perderán todas las fichas en sus fondos privados, es decir, Pago 2 = 0€.

Parámetro *P*: El parámetro P, **se calcula y se muestra en pantalla al final de cada ronda**. Sólo a partir de la ronda Z, determinada aleatoriamente al comienzo de la sesión y que es desconocida, pasará a ser la probabilidad de que se dé un evento de Armagedón. Hasta llegar a la ronda *Z*, dicha probabilidad será distinta a *P* e igual a 0%. El parámetro *P* será determinado como una transformación monótona decreciente del número de fichas contenidas en el fondo común. Es decir, cuanto más vacío/lleno se quede *G* al final de cada ronda, más alto/bajo será el valor de *P* en esa ronda.

Ronda final: Se debe alcanzar la ronda final para obtener el Pago 2. Puesto que un evento de Armagedón vaciaría tu fondo privado y terminaría el experimento para tu grupo, solo se puede llegar a la ronda final si un evento de Armagedón no tiene lugar. El valor exacto de la ronda final es desconocido y se determina aleatoriamente para cada grupo al comienzo del experimento.

Ronda de pago: De todas las rondas jugadas y para cada grupo, el ordenador seleccionará aleatoriamente una para que sea la ronda de pago. Tu extracción en esa ronda será convertida a euros, utilizando el tipo de cambio especificado al principio de estas instrucciones, y el resultado será tu Pago 1. El Pago 1 no se ve afectado por los eventos de Armagedón y por tanto, y a diferencia del Pago 2, no es necesario alcanzar la ronda final para asegurarlo.

Risk treatment (English)

Experiment Instructions

Introduction

This research is funded by the European Commission.

This is an experiment on decision-making. Your earnings will depend not only on your decisions but also on the decisions of others, and chance. Please pay attention to the instructions as a considerable amount of money is at stake. The estimated duration of this experiment is two hours.

At the beginning of the session, you will be randomly paired with three other participants. Therefore, the room will be divided into groups of four participants. The groups are independent of each other, meaning each group will form a separate world, independent of all other groups.

At the end of the session, you will receive your payment independently and privately. These instructions detail how you will make decisions and what your final payment will depend on. During the experiment, earnings and payments will be expressed in experimental tokens, which will be converted to euros at the end using the following exchange rate: 10 Tokens = 1€. Additionally, you will receive €3.5 as a participation fee (simply for arriving on time and participating in the experiment).

On your decision making

The experiment will unfold in several rounds, throughout which you will make decisions of the same type. Only the initial conditions may change from one round to another, and these will be determined by the individual decisions made by all members of your group in the previous rounds. The following paragraphs describe in more detail the possible decisions, initial conditions, and consequences.

At the beginning of each round, you will be asked to decide on the number of tokens N you wish to extract from a common pool G, which is shared among all members of your group and will start with its maximum capacity of 1300 tokens. The number of tokens to extract must be a whole number (i.e., no decimals) between 1 and 18. You will be shown on screen the amount of tokens available in G to make that decision. The other members of your group will be asked to make decisions of the same type. Once all group members have decided how many tokens to extract from G that round, the tokens you have extracted will be transferred to your private fund F, proceeding in the same way for each group member, and leaving G with the remaining tokens (i.e., the tokens not extracted by your group). Subsequently, a parameter P will be calculated for your group in this round, representing a percentage (0-100%), which will depend on the number of tokens remaining in G, such that the lower the content of G, the higher P will be.

At the end of each round, you will see a screen with your individual extraction, your group's collective extraction, the contents of G and F, and the parameter P for that round. Additionally, from the second round onwards, you will also see the history table of all the aforementioned parameters for all past rounds. Starting from a round Z, which will be randomly

determined at the beginning of the experiment, the parameter P will be the probability of an "Armageddon" event (or "end of the world") occurring, which would result in the premature and abrupt termination of the experiment. Neither the experiment participants nor the researchers will know which round Z will be during the session. If an "Armageddon" event takes place before the beginning of the next round, the world will end, and the experiment will end abruptly, thus emptying the private funds F of all group members (including you). In summary, until round Z, the probability of an "Armageddon" event interrupting the natural course of the experiment will be different from P (and equal to 0%), and from round Z onwards, this probability will become equal to the parameter P.

Assuming the experiment continues to the next round, 20 tokens will be added to G. In other words, G regenerates at a constant rate of 20 tokens per round. That is, at the beginning of the next round, G will contain the leftover tokens from the previous round plus 20 extra tokens. However, G can never exceed its maximum capacity, which is 1300 tokens. Therefore, in rounds where your group's collective extraction leaves G with a token deficiency of less than 20, the next round will simply start with G at its maximum capacity (since adding 20 tokens would exceed G's maximum capacity).

Once the new token content of G is determined, the next round will begin. Again, you will be shown the number of tokens in G and will decide how many to extract in that round. The process described above will be repeated for as many rounds as the experiment lasts, accumulating your individual extractions from each round into F until one of two things happens: either your group reaches the final round, ending the experiment, or an Armageddon event occurs, which, in addition to ending the experiment, will empty all private funds.

Payments and total earnings

Your earnings in the experiment will be determined as the sum of two types of payment:

Payment 1: From all rounds played, and for each group, the computer will randomly select one, the **payment round**. Your token extraction in that round will be converted to euros using the exchange rate specified at the beginning of these instructions. The final screen of the experiment will display your payment round, your individual extraction in that round, and the corresponding payment in euros.

Payment 2: At the beginning of the session, the computer will have randomly selected a round number for each group. This will define what we call the *final round* and will be unknown

to you. If your group reaches the final round, you will receive the equivalent of the contents of your private fund, in euros. Your private fund will have accumulated all your extractions throughout the experiment, from round 1 to the final round. However, if an "Armageddon" event occurs before the final round, all private funds of your group will be emptied, the experiment will end abruptly, and Payment 2 will therefore be equal to €0. The final screen will show the contents of your private fund when the experiment ends, as well as the corresponding payment (Payment 2).

Your total earnings for this experiment will be:

$$\text{Total} = \text{Payment 1} + \text{Payment 2} + 3{,}5€$$

where €3.5 is the participation fee.

Finally, during the session, you may be asked to guess the average individual extraction of the other members of your group in the next round. Depending on the accuracy of your response with respect to the actual value, you may earn an additional maximum payment of €0.5 per estimation.

Rules

The use of a calculator is not allowed in this experiment. Additionally, you cannot write anything anywhere or take any kind of notes during the experiment (unless the technical staff of the laboratory instructs you otherwise, such as when filling out the payment receipt).

Your participation in the experiment and any information about your earnings will be kept strictly confidential. The only places where your name will be found are your payment receipt, your participant form, and the laboratory's database. At no time will you be asked to reveal your identity to anyone during the session. Neither the researchers nor the other participants can personally associate you with any of your decisions. Please, to ensure the privacy of your decisions, do not communicate them to any other participant.

Please do not talk to anyone during the experiment. We ask everyone to please remain silent until the last round, and furthermore, until everyone has left the laboratory. If you have no questions, you are ready to begin. If you have any doubts and/or require any other type of assistance at any time, please raise your hand, and we will attend to you as soon as possible privately.

Glossary of important concepts and vocabulary

Common pool (G): The common pool is shared only among members of the same group. It cannot contain more tokens than it starts with, meaning it cannot be filled beyond its maximum capacity. The experiment begins with the common pool at its maximum capacity. The number of tokens in the common pool at the end of a round will determine the parameter P, such that the emptier the common pool, the higher P will be. In turn, the parameter P will be the probability of an Armageddon event occurring starting from round Z, which will have been randomly selected by the computer at the beginning of the session.

Private fund (F): Your private fund is solely yours, not shared with anyone. It accumulates all your individual extractions from the common pool throughout all rounds played in the experiment. In the event of an Armageddon event, all group private funds will be emptied, leaving 'Payment 2 = €0'.

Extraction (N): Each participant chooses the number of tokens to extract from the common pool once per round. An individual extraction is the decision made by one participant in a given round. Collective extraction is the sum of all individual extractions from the same group in a round. The sum of all your individual extractions will be stored in your private fund F. Extractions can only be whole numbers.

Armageddon event: An Armageddon event will occur with a probability of 0% until round Z, which will have been randomly determined at the beginning of the experiment and will be unknown. From that round onwards, this probability will become equal to the parameter P. If an Armageddon event occurs, all participants in your group will lose all tokens in their private funds, i.e., 'Payment 2 = €0'.

Parameter P: The parameter P **is calculated and displayed on screen at the end of each round**. Only from round Z onwards, which is randomly determined at the beginning of the session and unknown, will it become the probability of an Armageddon event taking place. Until reaching round Z, this probability will be different from P and equal to 0%. Parameter P will be determined as a decreasing monotonic transformation of the number of tokens contained in the common pool. That is, the emptier/fuller G becomes at the end of each round, the higher/lower the value of P will be in that round.

Final round: The final round must be reached to obtain Payment 2. Since an Armageddon event would empty your private fund and end the experiment for your group, the final round can only be reached if an Armageddon event does not occur. The exact value of the final round is unknown and is randomly determined for each group at the beginning of the experiment.

Payment round: From all rounds played and for each group, the computer will randomly select one to be the payment round. Your token extraction in that round will be converted to euros using the exchange rate specified at the beginning of these instructions, and the result will be your Payment 1. Payment 1 is not affected by Armageddon events and therefore, unlike Payment 2, reaching the final round is not necessary to secure it.

Ambiguity treatment (Spanish)

Instrucciones del experimento

Introducción

Esta investigación está financiada por la Comisión Europea.

Este es un experimento sobre toma de decisiones. Tus ganancias dependerán no solo de tus decisiones, sino de las decisiones de los demás, y del azar. Por favor, presta atención a las instrucciones ya que una cantidad considerable de dinero está en juego. La duración estimada de este experimento es dos horas.

Al comienzo de la sesión, serás emparejado aleatoriamente con otros 3 participantes. Por tanto, la sala se dividirá en grupos de 4 participantes. Los grupos son independientes entre sí, es decir, cada grupo formará un mundo distinto, independiente de todos los demás grupos.

Al final de la sesión, recibirás tu pago de forma independiente y privada. En estas instrucciones se detalla cómo tomarás decisiones y de qué va a depender tu pago final. Durante el experimento, las ganancias y los pagos se expresarán en *fichas* experimentales, que serán convertidas a euros al final, utilizando el siguiente tipo de cambio: 10 Fichas = 1€. Además, recibirás 3,5€ como tasa de participación (simplemente por llegar puntualmente y participar en el experimento).

Sobre tu toma de decisiones

El experimento se desarrollará en varias rondas, a lo largo de las cuales deberás tomar decisiones de un mismo tipo. Solo las condiciones iniciales pueden cambiar de una ronda a otra, y éstas serán determinadas por las decisiones individuales tomadas por todos los miembros de tu grupo

en las rondas pasadas. En los próximos párrafos se describen en más detalle las posibles decisiones, condiciones iniciales y consecuencias.

Al comienzo de cada ronda, se te pedirá que decidas el número de fichas *N* que deseas extraer de un fondo común *G*, que es compartido entre todos los miembros de tu grupo y comenzará con su capacidad máxima de 1300 fichas. El número de fichas a extraer deberá ser un número entero (es decir, sin decimales) entre 1 y 18. Se te mostrará en pantalla la cantidad de fichas disponibles en *G* para tomar dicha decisión. Al resto de componentes de tu grupo se les pedirá que tomen decisiones del mismo tipo. Una vez todos los miembros del grupo hayan decidido cuántas fichas extraer de *G* esa ronda, las fichas que hayas extraído serán transferidas a tu fondo privado *F*, procediendo del mismo modo para cada miembro del grupo, y dejando *G* con las fichas restantes (es decir, las fichas no extraídas por tu grupo). A continuación, un parámetro *P* se calculará para tu grupo en esta ronda, que representará un porcentaje (0-100%), que dependerá del número de fichas que queden en *G*, de tal forma que cuanto menor sea el contenido de *G*, mayor será *P*. El parámetro *P* será desconocido.

Al final de cada ronda, se te mostrará una pantalla con tu extracción individual, la extraccion colectiva de tu grupo y los contenidos de *G* y *F* para esa ronda. Además, a partir de la segunda ronda también se te mostrará el histórico de todos los parámetros mencionados anteriormente, para todas las rondas pasadas. A partir de una ronda *Z*, que será determinada aleatoriamente al comienzo del experimento, el parámetro *P* será la probabilidad de que suceda un evento de "Armagedón" (o "fin del mundo"), que resultaría en la terminación precoz y abrupta del experimento. Ni los participantes del experimento ni los investigadores podrán saber cual será la ronda *Z* durante la sesión. Si un evento de "Armagedón" tiene lugar antes del comienzo de la siguiente ronda, el mundo acabará y el experimento finalizará abruptamente, vaciando así los fondos privados *F* de todos los miembros del grupo (incluido tú). En resumen, hasta la ronda *Z*, la probabilidad de que un evento de "Armagedón" interrumpa el curso natural del experimento será distinta a *P* (e igual a 0%) y, a partir de la ronda *Z*, dicha probabilidad pasará a ser igual al parámetro *P*, cuyo valor será calculado al final de cada ronda y desconocido para todos.

Asumiendo que el experimento continúe la ronda siguiente, 20 fichas serán añadidas a *G*. En otras palabras, *G* se regenera a una velocidad constante de 20 fichas por ronda. Es decir, al principio de la siguiente ronda, *G* contendrá las fichas sobrantes de la ronda anterior más 20 fichas extra. Sin embargo, *G* jamás puede superar su capacidad máxima, que es de 1300 fichas. Por lo tanto, en las rondas en las que la extracción colectiva de tu grupo deje *G* con una deficiencia de

fichas menor que 20, la siguiente ronda simplemente comenzará con un *G* en su máximo de capacidad (ya que sumar 20 fichas implicaría exceder la capacidad máxima de *G*).

Una vez determinado el nuevo contenido en fichas de *G*, comenzará la ronda siguiente. De nuevo, se te mostrará el número de fichas en *G* y deberás decidir cuántas extraer en esa ronda. El proceso descrito anteriormente será repetido tantas veces como rondas dure el experimento, acumulando tus extracciones individuales de cada ronda en *F* hasta que suceda una de dos: que tu grupo llegue a la ronda final, en la que finalizaría el experimento, o que suceda un evento de Armagedón, que además de terminar el experimento vaciaría todos los fondos privados.

Pagos y ganancias totales

Tus ganancias en el experimento serán determinadas como la suma de dos tipos de pago:

Pago 1: De todas las rondas jugadas y para cada grupo, el ordenador seleccionará aleatoriamente una, la **ronda de pago**. Tu extracción de fichas en dicha ronda será convertida a euros utilizando el tipo de cambio especificado al principio de estas instrucciones. En la pantalla final del experimento se mostrarán tu ronda de pago, tu extracción individual en esa misma ronda y el pago correspondiente en euros.

Pago 2: Al principio de la sesión, el ordenador habrá seleccionado al azar un número de ronda para cada grupo. Esto definirá lo que llamamos la *ronda final* y será desconocida para ti. Si tu grupo llega a la ronda final, recibirás lo equivalente a lo contenido en tu fondo privado, en euros. Tu fondo privado habrá acumulado todas tus extracciones a lo largo del experimento, desde la ronda 1 hasta la final. Sin embargo, si ocurre un evento de "Armagedón" antes de la ronda final, todos los fondos privados de tu grupo se vaciarán, el experimento terminará abruptamente y el Pago 2 será, por tanto, igual a 0€. La pantalla final mostrará los contenidos de tu fondo privado cuando acabe el experimento, así como el correspondiente pago (Pago 2).

Tus ganancias totales para este experimento serán:

$$\text{Total} = \text{Pago 1} + \text{Pago 2} + 3{,}5€$$

donde 3,5€ es la tasa de participación.

Finalmente, durante la sesión puede ser que se te pida adivinar la extracción individual media de los demás miembros de tu grupo en la siguiente ronda. Dependiendo de la precisión de tu respuesta con respecto al valor real, podrás ganar un pago extra máximo de 0,5€ por estimación.

Reglas

El uso de la calculadora no está permitido en este experimento. Además, no se puede escribir nada en ninguna parte ni tomar ningún tipo de apunte durante el experimento (a no ser que el equipo técnico del laboratorio te indique lo contrario en algún momento como, por ejemplo, al rellenar el recibo de pago).

Tu participación en el experimento y cualquier información sobre tus ganancias serán mantenidas estrictamente confidenciales. Los únicos lugares donde se encontrará tu nombre son tu recibo de pago, tu formulario de participante y la base de datos del laboratorio. En ningún momento se te pedirá que descubras tu identidad a nadie durante la sesión. Ni los investigadores ni los demás participantes podrán asociarte a ti personalmente con ninguna de tus decisiones. Por favor, para asegurar la privacidad de tus decisiones, no las comuniques a ningún otro participante.

Por favor, no hables con nadie durante el experimento. Rogamos a todos que por favor se mantengan en silencio hasta la ultima ronda y, lo que es más, hasta que todos hayan salido del laboratorio. Si no tienes preguntas, estás listo/a para comenzar. Si tienes alguna duda y/o requieres de algún otro tipo de asistencia en cualquier momento, por favor levanta la mano y te atenderemos lo antes posible de forma privada.

Glosario de conceptos importantes y vocabulario

Fondo común (*G*): El fondo común es compartido únicamente entre miembros del mismo grupo. No puede contener más fichas que con las que empieza, es decir, no se puede llenar mas allá de su capacidad máxima. El experimento empieza con el fondo común lleno al máximo de su capacidad. La cantidad de fichas en el fondo común al final de una ronda determinará el parámetro *P*, de tal forma que cuanto más vacío esté el fondo común, mayor será *P*. A su vez, el parámetro *P* será la probabilidad de que ocurra un evento de Armagedón a partir de una ronda *Z*, que habrá sido seleccionada de manera aleatoria por el ordenador al comienzo de la sesión.

Fondo privado (*F*): Tu fondo privado es solo tuyo, no se comparte con nadie. En él se acumulan todas tus extracciones individuales del fondo común a lo largo de todas las rondas jugadas en el experimento. En el caso de un evento de Armagedón, todos los fondos privados del grupo serán vaciados, dejando el Pago 2 = 0€.

Extracción (*N*): Cada participante elige el número de fichas a extraer del fondo común una vez por ronda. Llamamos extracciones individuales a las decisiones de cada participante en una

ronda dada. Llamamos extracción colectiva a la suma de todas las extracciones individuales del mismo grupo y ronda. La suma de todas tus extracciones individuales será almacenada en tu fondo privado *F*. Las extracciones solo pueden ser números enteros.

Evento de Armagedón: Un evento de Armagedón ocurrirá con probabilidad 0% hasta la ronda *Z*, que habrá sido determinada aleatoriamente al principio del experimento y será desconocida. A partir de dicha ronda, esa probabilidad pasará a ser el parámetro *P*. Si ocurre un evento de Armagedón, todos los participantes de tu grupo perderán todas las fichas en sus fondos privados, es decir, Pago 2 = 0€.

Parámetro *P*: El parámetro P, se calcula al final de cada ronda, **pero nunca se te comunicará**. Sólo a partir de la ronda Z, determinada aleatoriamente al comienzo de la sesión y que es desconocida, pasará a ser la probabilidad de que se dé un evento de Armagedón. Hasta llegar a la ronda *Z*, dicha probabilidad será distinta a *P* e igual a 0%. El parámetro *P* será determinado como una transformación monótona decreciente del número de fichas contenidas en el fondo común. Es decir, cuanto más vacío/lleno se quede *G* al final de cada ronda, más alto/bajo será el valor de *P* en esa ronda.

Ronda final: Se debe alcanzar la ronda final para obtener el Pago 2. Puesto que un evento de Armagedón vaciaría tu fondo privado y terminaría el experimento para tu grupo, solo se puede llegar a la ronda final si un evento de Armagedón no tiene lugar. El valor exacto de la ronda final es desconocido y se determina aleatoriamente para cada grupo al comienzo del experimento.

Ronda de pago: De todas las rondas jugadas y para cada grupo, el ordenador seleccionará aleatoriamente una para que sea la ronda de pago. Tu extracción en esa ronda será convertida a euros, utilizando el tipo de cambio especificado al principio de estas instrucciones, y el resultado será tu Pago 1. El Pago 1 no se ve afectado por los eventos de Armagedón y por tanto, y a diferencia del Pago 2, no es necesario alcanzar la ronda final para asegurarlo.

Ambiguity treatment (English)

Experiment Instructions

Introduction

This research is funded by the European Commission.

This is an experiment on decision-making. Your earnings will depend not only on your decisions but also on the decisions of others, and chance. Please pay attention to the instructions as a considerable amount of money is at stake. The estimated duration of this experiment is two hours.

At the beginning of the session, you will be randomly paired with three other participants. Therefore, the room will be divided into groups of four participants. The groups are independent of each other, meaning each group will form a distinct world, independent of all other groups.

At the end of the session, you will receive your payment independently and privately. These instructions detail how you will make decisions and what your final payment will depend on. During the experiment, earnings and payments will be expressed in experimental tokens, which will be converted to euros at the end using the following exchange rate: 10 Tokens = 1€. Additionally, you will receive €3.5 as a participation fee (simply for arriving on time and participating in the experiment).

About Your Decision Making

The experiment will unfold over several rounds, during which you will make decisions of the same type. Only the initial conditions may change from one round to another, and these will be determined by the individual decisions made by all members of your group in the past rounds. The next paragraphs describe in more detail the possible decisions, initial conditions, and consequences.

At the beginning of each round, you will be asked to decide the number of tokens N you wish to extract from a common pool G, which is shared among all members of your group and will start with its maximum capacity of 1300 tokens. The number of tokens to extract must be an integer (i.e., without decimals) between 1 and 18. You will be shown on the screen the amount of tokens available in G to make that decision. The other members of your group will be asked to make decisions of the same type. Once all members of the group have decided how many tokens to extract from G that round, the tokens you have extracted will be transferred to your private fund F, proceeding in the same way for each group member, and leaving G with the remaining tokens (i.e., the tokens not extracted by your group). Then, a parameter P will be calculated for your group in this round, representing a percentage (0-100%), which will depend on the number of tokens remaining in G, so that the lower the content of G, the higher P will be. The parameter P will be unknown.

At the end of each round, you will be shown a screen with your individual extraction, your group's collective extraction, and the contents of G and F for that round. Additionally, starting from the second round, you will also be shown the history table of all the parameters mentioned above for all past rounds. From a round Z, which will be randomly determined at the beginning of the experiment, the parameter P will be the probability of an "Armageddon" event occurring (or "end of the world"), which would result in the premature and abrupt termination of the experiment. Neither the experiment participants nor the researchers will know which round Z will be during the session. If an "Armageddon" event takes place before the start of the next round, the world will end, and the experiment will abruptly end, thus emptying the private funds F of all group members (including you). In summary, until round Z, the probability of an "Armageddon" event interrupting the natural course of the experiment will be different from P (and equal to 0%), and from round Z onwards, this probability will be equal to the parameter P, the value of which will be calculated at the end of each round and unknown to all.

Assuming the experiment continues to the next round, 20 tokens will be added to G. In other words, G regenerates at a constant rate of 20 tokens per round. That is, at the beginning of the next round, G will contain the leftover tokens from the previous round plus 20 extra tokens. However, G can never exceed its maximum capacity, which is 1300 tokens. Therefore, in rounds where your group's collective extraction leaves G with a deficiency of tokens less than 20, the next round will simply start with G at its maximum capacity (since adding 20 tokens would exceed G's maximum capacity).

Once the new token content of G is determined, the next round will begin. Again, you will be shown the number of tokens in G and will need to decide how many to extract in that round. The process described above will be repeated as many times as rounds the experiment lasts, accumulating your individual extractions from each round into F until one of two things happens: either your group reaches the final round, ending the experiment, or an Armageddon event occurs, which, in addition to ending the experiment, would empty all private funds.

Payments and Total Earnings

Your earnings in the experiment will be determined as the sum of two types of payments:

Payment 1: From all rounds played and for each group, the computer will randomly select one, the **payment round**. Your token extraction in that round will be converted to euros using the exchange rate specified at the beginning of these instructions. The final screen of the experiment

will show your payment round, your individual extraction in that round, and the corresponding payment in euros.

Payment 2: At the beginning of the session, the computer will have randomly selected a round number for each group. This will define what we call the final round and will be unknown to you. If your group reaches the final round, you will receive the equivalent of what is contained in your private fund, in euros. Your private fund will have accumulated all your extractions throughout the experiment, from round 1 to the final round. However, if an "Armageddon" event occurs before the final round, all private funds of your group will be emptied, the experiment will end abruptly, and Payment 2 will, therefore, be equal to €0. The final screen will show the contents of your private fund when the experiment ends, as well as the corresponding payment (Payment 2).

Your total earnings for this experiment will be:

$$\text{Total} = \text{Payment 1} + \text{Payment 2} + 3{,}5€$$

where €3.5 is the participation fee.

Finally, during the session, you may be asked to guess the average individual extraction of the other members of your group in the next round. Depending on the accuracy of your response with respect to the actual value, you may earn an additional maximum payment of €0.5 per estimate.

Rules

The use of a calculator is not allowed in this experiment. Additionally, you cannot write anything anywhere or take any kind of notes during the experiment (unless the technical staff of the laboratory instructs you otherwise, such as when filling out the payment receipt).

Your participation in the experiment and any information about your earnings will be kept strictly confidential. The only places where your name will be found are your payment receipt, your participant form, and the laboratory's database. At no time will you be asked to reveal your identity to anyone during the session. Neither the researchers nor the other participants can personally associate you with any of your decisions. Please, to ensure the privacy of your decisions, do not communicate them to any other participant.

Please do not talk to anyone during the experiment. We ask everyone to please remain silent until the last round, and furthermore, until everyone has left the laboratory. If you have no questions, you are ready to begin. If you have any doubts and/or require any other type of

assistance at any time, please raise your hand, and we will attend to you as soon as possible privately.

Glossary of Important Concepts and Vocabulary

Common Pool (G): The common pool is shared only among members of the same group. It cannot contain more tokens than it starts with, meaning it cannot be filled beyond its maximum capacity. The experiment begins with the common pool at its maximum capacity. The number of tokens in the common pool at the end of a round will determine the parameter P, such that the emptier the common pool, the higher P will be. In turn, the parameter P will be the probability of an Armageddon event occurring starting from round Z, which will have been randomly selected by the computer at the beginning of the session.

Private fund (F): Your private fund is yours alone, not shared with anyone. It accumulates all your individual extractions from the common pool throughout all the rounds played in the experiment. In the case of an Armageddon event, all private funds of the group will be emptied, leaving "Payment 2 = €0".

Extraction (N): Each participant chooses the number of tokens to extract from the common pool once per round. An individual extraction is the decision made by one participant in a given round. Collective extraction is the sum of all individual extractions from the same group in a round. The sum of all your individual extractions will be stored in your private fund F. Extractions can only be whole numbers.

Armageddon event: An Armageddon event will occur with a probability of 0% until round Z, which will have been randomly determined at the beginning of the experiment and will be unknown. From that round onwards, this probability will become equal to the parameter P. If an Armageddon event occurs, all participants in your group will lose all tokens in their private funds, i.e., 'Payment 2 = €0'.

Parameter P: The parameter P is calculated at the end of each round, **but it will never be communicated to you**. Only from round Z onwards, which is randomly determined at the beginning of the session and unknown, will it become the probability of an Armageddon event taking place. Until reaching round Z, this probability will be different from P and equal to 0%. Parameter P will be determined as a decreasing monotonic transformation of the number of tokens contained in the common pool. That is, the emptier/fuller G becomes at the end of each round, the higher/lower the value of P will be in that round.

Final round: The final round must be reached to obtain Payment 2. Since an Armageddon event would empty your private fund and end the experiment for your group, the final round can only be reached if an Armageddon event does not occur. The exact value of the final round is unknown and is randomly determined for each group at the beginning of the experiment.

Payment round: From all rounds played and for each group, the computer will randomly select one to be the payment round. Your token extraction in that round will be converted to euros using the exchange rate specified at the beginning of these instructions, and the result will be your Payment 1. Payment 1 is not affected by Armageddon events and therefore, unlike Payment 2, reaching the final round is not necessary to secure it.

Appendix F: Information sheet

Spanish

Hoja informativa para los participantes

El papel de la percepción y el comportamiento del consumidor en la transición hacia la economía circular

Has sido invitado/a a participar en un experimento sobre toma de decisiones como parte de un proyecto de investigación, que forma parte de la tesis doctoral del doctorando Dimitris Georgantzis Garcia, de la Universidad de Sheffield (Reino Unido). Antes de decidir si quieres participar o no, es importante que entiendas los objetivos de esta investigación y qué es lo que la participación requiere. Si necesitas alguna aclaración o más información, puedes levantar la mano y preguntar al equipo del laboratorio o contactar con los investigadores usando la información de contacto que se te facilita al final de esta hoja informativa.

1. **Propósito**

En este estudio, nos interesa la percepción de las personas sobre temas relacionados con la economía circular. La economía circular es un concepto nuevo que pretende conseguir y garantizar la calidad medioambiental y el bienestar social a través de nuevos modelos de empresa, producción y consumo basados en el reciclaje y la reutilización de productos y materiales, así como la reducción del consumo de recursos y de los residuos generados (por ejemplo, a través del reacondicionamiento de productos, sistemas de intercambio de bienes e iniciativas sobre alquiler o mercados de segunda mano).

Este estudio lo lleva a cabo el doctorando Dimitris Georgantzis Garcia y sus supervisores académicos (Dra. Efi Vasileiou, Dra. Eva Kipnis and Dr. Adrian Solomon) como parte su tesis doctoral, que investiga el papel de la percepción y comportamiento del consumidor en la transición hacia la economía circular. La fecha prevista para la finalización de este proyecto de doctorado es septiembre de 2023.

2. **Selección de participantes**

Los participantes serán reclutados a través de la base de datos del laboratorio de economía experimental (LEE, Universitat Jaume I, España) para participar en un experimento de toma de decisiones. Buscamos una representación comparable de ambos géneros.

3. ¿Es obligatorio participar?

La participación no es obligatoria. Si decides participar, se te entregará esta hoja informativa para que la conserves y se te pedirá que completes y firmes la hoja de consentimiento. Eres libre de dejar de participar a lo largo de la sesión experimental sin que haya consecuencias negativas. Sin embargo, no será posible retirarse del estudio tras la recolección de los datos ya que serán anónimos y, por tanto, indistinguibles entre participantes. Si tienes más preguntas sobre esto por favor no dudes en contactar con el investigador principal por correo: dgeorgantzisgarcia1@sheffield.ac.uk.

Ten en cuenta que al participar en este experimento no se crea ningún acuerdo vinculante ni se pretende crear una relación suya de trabajo con la Universidad de Sheffield o con el LEE.

4. ¿Qué sucederá si decido participar en el experimento? ¿Qué debo hacer?

Te pediremos que sigas las instrucciones del experimento y del equipo del LEE para participar en condiciones controladas en el laboratorio, y que recojas tus ganancias y abandones el laboratorio de forma ordenada y segura. La duración estimada de este experimento es 2h.

5. ¿Cuáles son las posibles desventajas y riesgos de participar en el experimento?

Los riesgos de participar son los mismos que conlleva tu día a día. En el contexto actual de pandemia, éstos incluyen los riesgos asociados al COVID. Para minimizar estos riesgos, deberás seguir estrictamente todas las medidas que se te habrán comunicado en el email de invitación. El incumplimiento de estas medidas supondría tu retirada inmediata del estudio para garantizar la seguridad del resto de participantes, investigadores y personal del laboratorio. Además, te pedimos que sigas siempre las indicaciones comunicadas por el equipo del LEE y las señales indicativas colgadas en la zona del Edificio de Investigación II, donde se ubica el LEE. Si tienes cualquier pregunta en relación con qué se debe y qué no se debe hacer, por favor no dudes en preguntar a alguien del equipo del LEE el día del experimento.

6. ¿Cuáles son las posibles ventajas de participar en el experimento?

Los beneficios inmediatos de participar incluyen una remuneración monetaria que dependerá no solo de tus decisiones, sino también de las de los demás participantes y del azar. Además, una tasa base de 3,5€ se te pagará como tasa de participación, independientemente del resultado final, solo por llegar puntual y participar.

En cuanto a beneficios a largo plazo, esperamos que esta investigación contribuya al avance de la ciencia en aspectos conductuales de la economía circular, con el fin de llegar a entender mejor sus implicaciones y garantizar una transición, inclusiva y equitativa, hacia sociedades más sostenibles desde el punto de vista medioambiental, económico y social.

7. ¿Se mantendrá la confidencialidad de mi participación en este proyecto?

Toda la información recogida sobre ti a lo largo de la investigación será estrictamente confidencial y será anonimizada en el momento de la recogida de datos. Esto garantiza que no se te podrá identificar con tus decisiones más allá de ese momento. Los datos identificables solamente serán manejados por el laboratorio puesto que ya formas parte de su base de datos. Los investigadores no tienen acceso a esos datos. Si aceptas que se comparta tu información anónima con otros investigadores (por ejemplo, haciendo que esté disponible en bases de datos) entonces tus datos personales no serán incluidos, a menos que así lo pidas expresamente.

8. ¿Cuáles son las bases legales para el tratamiento de mi información personal?

De acuerdo con la legislación de protección de datos, estamos obligados a informarte de que las bases legales que aplicamos para tratar tus datos personales suponen que “el tratamiento de los datos es necesario para llevar a cabo alguna tarea de interés público” (Artículo 6(1)(e)). Puedes acceder a más información en la página de información de privacidad de la universidad https://www.sheffield.ac.uk/govern/data-protection/privacy/general.

9. ¿Qué sucederá con los datos recogidos y los resultados de este proyecto de investigación?

Hasta el final de la recogida de datos, el laboratorio desempeñará un papel de procesador de datos para anonimizar y entregar los datos a los investigadores. La base de datos estará guardada en el ordenador personal del investigador principal y se hará una copia de seguridad, protegida

por una clave en el repositorio de la Universidad de Sheffield hasta pasado un año de haber completado el doctorado el Sr. Georgantizis-Garcia o la publicación de los resultados, lo que ocurra primero. Estos datos serán analizados por el investigador principal y sus supervisores. Es probable que, tras la finalización del doctorado y la publicación de la investigación asociada, otros investigadores puedan pensar en usos adicionales de estos datos y responder a futuras preguntas de investigación. Se te pedirá tu consentimiento explícito para compartir tus datos de esta forma en el formulario de consentimiento, que sigue a esta hoja informativa.

Los datos serán analizados estadísticamente durante el proyecto de doctorado y es probable que los resultados del estudio lleven a publicaciones en revistas científicas de alto impacto. Es muy probable es que las publicaciones sean de libre acceso (tal y como requiere el financiador del proyecto) y los participantes tendrán acceso ilimitado y gratis a ellas. Los participantes no serán identificados (ni identificables) en ninguna de las publicaciones.

Los datos personales identificables no serán almacenados más allá de la recogida de datos. Los datos anonimizados serán almacenados en los servidores de la universidad y protegidos bajo clave hasta pasado un año del final del doctorado o publicación de los resultados (lo que ocurra primero). Tras la publicación de los resultados, los datos podrán ponerse a disposición de otros investigadores (por ejemplo, en un repositorio) solo cuando y si has dado tu consentimiento explícito.

10. ¿Quién organiza y financia la investigación?

Esta investigación está financiada por el programa de investigación e innovación *Horizon 2020* de la Unión Europea en el marco del programa *Maria Sklodowska-Curie Innovative Training Networks* (H2020-MSCA-ITN-2018), con número de acuerdo de subvención 814247 (ReTraCE project).

11. ¿Quién es el controlador de datos?

La Universidad de Sheffield actuará como controlador de datos para este estudio. Esto significa que la universidad es responsable de cuidar su información y usarla adecuadamente.

12. ¿Quién ha revisado éticamente el proyecto?

Este proyecto ha sido aprobado éticamente a través del procedimiento de revisión ética de la Universidad de Sheffield, administrado por la escuela de administración.

13. ¿Qué sucede si algo sale mal y deseo hacer una queja sobre la investigación o informar de un problema o incidente?

Si no estás satisfecho con algún aspecto de la investigación y deseas realizar una queja, por favor ponte en contacto con el Sr. Dimitris Georgantzis-Garcia (dgeorgantzisgarcia1@sheffield.ac.uk) en primera instancia. Si sientes que tu queja no está siendo tratada de forma satisfactoria, puedes contactar con su supervisora de tesis Dr.Eva Kipnis (eva.kipnis@sheffield.ac.uk). Si la queja está relacionada con cómo se han tratado tus datos personales, puedes encontrar información acerca de cómo presentar una queja en el aviso de privacidad de la universidad https://www.sheffield.ac.uk/govern/data-protection/privacy/general.

14. Contacto(s) para más información

Investigador principal: Sr. Dimitris Georgantzis-Garcia

Dirección:

CITY College, University of York Europe Campus,

Doctoral students' office,

3 Leontos Sofou st.,

546 26, Thessaloniki,

Greece

Tel.: (+30) 2310 536 544, 528 450 (ext. 224 026)

Email(s): dgeorgantzisgarcia1@sheffield.ac.uk; dgarcia@seerc.org

Supervisora: Dra. Eva Kipnis

Dirección:

Management School, Room D050

Sheffield University Management School

Conduit Road

Sheffield, S10 1FL, UK

Tel.: +44 114 222 3461

Email(s): eva.kipnis@sheffield.ac.uk

Puedes encontrar una copia de esta hoja informativa y de la hoja de consentimiento en el último email enviado a tu dirección desde la cuenta de reclutamiento del laboratorio. Además, en cualquier momento durante este proyecto de investigación podrás solicitar cualquiera de los documentos a los investigadores, utilizando los datos de contacto proporcionados en esta hoja.

¡Gracias por participar en nuestro proyecto de investigación!

English translation

Information Sheet for Participants

The Role of Consumer Perception and Behaviour in the Transition towards the Circular Economy

You have been invited to participate in an experiment about decision-making as part of a research project, which is a component of the doctoral Thesis of Dimitris Georgantzis Garcia, a doctoral candidate at the University of Sheffield (United Kingdom). Before deciding whether you want to participate or not, it is important that you understand the objectives of this research and what participation entails. If you need any clarification or more information, you can raise your hand and ask the laboratory team or contact the researchers using the contact information provided at the end of this information sheet.

1. Purpose

In this study, we are interested in people's perception of issues related to the circular economy. The circular economy is a new concept that aims to achieve and ensure environmental quality

and social welfare through new business, production, and consumption models based on recycling and reusing products and materials, as well as reducing resource consumption and waste generation (for example, through product refurbishment, goods exchange systems, and initiatives for renting or second-hand markets).

This study is conducted by doctoral candidate Dimitris Georgantzis Garcia and his academic supervisors (Dr. Efi Vasileiou, Dr. Eva Kipnis, and Dr. Adrian Solomon) as part of his doctoral Thesis, which investigates the role of consumer perception and behaviour in the transition to a circular economy. The expected completion date for this doctoral project is September 2023.

2. Participant selection

Participants will be recruited through the database of the Laboratory of Experimental Economics (LEE, Jaume I University, Spain) to participate in a decision-making experiment. We seek a comparable representation of both genders.

3. Is participation mandatory?

Participation is not mandatory. If you decide to participate, you will be given this information sheet to keep, and you will be asked to complete and sign the consent form. You are free to withdraw from participation during the experimental session without any negative consequences. However, it will not be possible to withdraw from the study after data collection as the data will be anonymous and therefore indistinguishable among participants. If you have further questions about this, please do not hesitate to contact the principal investigator by email: dgeorgantzisgarcia1@sheffield.ac.uk.

Please note that participating in this experiment does not create any binding agreement nor does it intend to create a working relationship with the University of Sheffield or with LEE.

4. What will happen if I decide to participate in the experiment? What should I do?

You will be asked to follow the experiment's instructions and LEE’s staff to participate under controlled conditions in the laboratory, and to collect your earnings and leave the laboratory in an orderly and safe manner. The estimated duration of this experiment is 2 hours.

5. What are the possible disadvantages and risks of participating in the experiment?

The risks of participation are the same as those in your daily life. In the current pandemic context, these include risks associated with COVID. To minimize these risks, you must strictly follow all measures communicated to you in the invitation email. Non-compliance with these measures would result in your immediate withdrawal from the study to ensure the safety of other participants, researchers, and laboratory staff. Additionally, we ask you to always follow the instructions communicated by the LEE team and the signs posted in the area of 'Research Building II', where the LEE is located. If you have any questions regarding what should and should not be done, please do not hesitate to ask a member of LEE's staff on the day of the experiment.

6. What are the possible advantages of participating in the experiment?

The immediate benefits of participating include monetary compensation that depends not only on your decisions but also on those of other participants, and chance. Additionally, a base rate of €3.5 will be paid to you as a participation fee, regardless of the final outcome, just for arriving on time and participating.

Regarding long-term benefits, we hope that this research will contribute to advancing the science of behavioural aspects of the circular economy, in order to better understand its implications and ensure an inclusive and equitable transition to more sustainable societies from an environmental, economic, and social perspective.

7. Will the confidentiality of my participation in this project be maintained?

All information collected about you during the research will be strictly confidential and anonymized at the time of data collection. This ensures that you cannot be identified with your decisions beyond that moment. Identifiable personal data will only be handled by the laboratory since you are already part of their database. Researchers do not have access to this data. If you agree to share your anonymous information with other researchers (for example, by making it available in databases), then your personal data will not be included unless expressly requested by you.

8. What are the legal bases for processing my personal information?

In accordance with data protection legislation, we are required to inform you that the legal bases we apply for processing your personal data entail that "the processing of data is necessary for the performance of some public interest task" (Article 6(1)(e)). You can access more information on the university's privacy information page https://www.sheffield.ac.uk/govern/data-protection/privacy/general.

9. What will happen to the data collected and the results of this research project?

Until the end of data collection, the laboratory will act as a data processor to anonymize and deliver the data to the researchers. The database will be stored on the principal investigator's personal computer and a backup will be made, protected by a key in the University of Sheffield repository until one year after Mr. Georgantizis-Garcia completes his doctoral degree or the publication of the results, whichever occurs first. These data will be analysed by the principal investigator and his supervisors. After the completion of the doctoral degree and the publication of the associated research, other researchers may consider additional uses of this data and respond to future research questions. Your explicit consent will be requested to share your data in this way in the consent form, which follows this information sheet.

The data will be statistically analysed during the doctoral project and it is likely that the study results will lead to publications in high-impact scientific journals. The publications are likely to be open access (as required by the project funder) and participants will have unlimited and free access to them. Participants will not be identified (nor identifiable) in any of the publications.

Identifiable personal data will not be stored beyond data collection. Anonymized data will be stored on university servers and protected with a key until one year after the end of the doctoral degree or publication of the results (whichever occurs first). After the results are published, the data may be made available to other researchers (for example, in a repository) only when and if you have given your explicit consent.

10. Who organizes and funds the research?

This research is funded by the European Union's Horizon 2020 research and innovation program under the Marie Sklodowska-Curie Innovative Training Networks (H2020-MSCA-ITN-2018) program, with grant agreement number 814247 (ReTraCE project).

11. Who is the data controller?

The University of Sheffield will act as the data controller for this study. This means that the university is responsible for taking care of your information and using it appropriately.

12. Who has ethically reviewed the project?

This project has been ethically approved through the ethical review procedure of the University of Sheffield, administered by the Management School.

13. What happens if something goes wrong and I want to make a complaint about the research or report a problem or incident?

If you are not satisfied with any aspect of the research and wish to make a complaint, please contact Mr. Dimitris Georgantzis-Garcia (dgeorgantzisgarcia1@sheffield.ac.uk) in the first instance. If you feel that your complaint is not being addressed satisfactorily, you can contact his Thesis supervisor Dr. Eva Kipnis (eva.kipnis@sheffield.ac.uk). If the complaint is related to how your personal data has been treated, you can find information on how to lodge a complaint in the university's privacy notice https://www.sheffield.ac.uk/govern/data-protection/privacy/general.

14. Contact(s) for Further Information

Principal Investigator: Mr. Dimitris Georgantzis-Garcia

Address:

CITY College, University of York Europe Campus,

Doctoral students' office,

3 Leontos Sofou St.,

546 26, Thessaloniki,

Greece

Tel.: (+30) 2310 536 544, 528 450 (ext. 224 026)

Email(s): dgeorgantzisgarcia1@sheffield.ac.uk; dgarcia@seerc.org

Supervisor: Dr. Eva Kipnis

Address:

Management School, Room D050

Sheffield University Management School

Conduit Road

Sheffield, S10 1FL, UK

Tel.: +44 114 222 3461

Email(s): eva.kipnis@sheffield.ac.uk

You can find a copy of this information sheet and the consent form in the last email sent to your address from the laboratory recruitment account. Additionally, at any time during this research project, you can request any of the documents from the researchers using the contact information provided in this sheet.

Thank you for participating in our research project!

Appendix G: Statistical tests for model selection (Linear mixed model, Chapter 6)

This Appendix is complementary to Chapter 6 and concerns the use of F-tests, Likelihood-ratio (LR) tests, and information criteria (AIC and BIC) in building the most appropriate model to balance parsimony, coherence with the research focus, and model fit (Verbeek, 2008). LR tests are conducted by fitting the same models using maximum likelihood (ML), rather than restricted maximum likelihood (REML) which was employed overall and for all other tests. The models compared are described in Table 39 below. All models compared are linear mixed models (LMM) with random intercepts for groups, and subjects within groups.

Model	Description
Baseline	Intercept-only model.
Treatment	Treatment-only model.
Model 1	Experimental parameters (institutional setting), demographics and cluster mean controls for others' consumption, gender and age.
Model 1.1	Model 1 but without cluster means for age.
Model 2	Model 1.1 + Self-reported factors (psychological) and their cluster means.
Model 2.1	Model 2 but only cluster means for others' consumption, gender and risk aversion.
Model 2.2	Model 2.1 but without BISUST.
Model 3	Model 2 + interaction terms between others' consumption and psychological and demographic factors.
Model 3.1	Model 3 but with interaction terms with others' consumption only for gender, psychological distance, dispositions toward sustainable consumption, and concrete (internal) and abstract (external) intentions.
Model 3.2	Model 3.1 but without the interaction term between others' consumption and external behavioural intentions.

Table 39. Linear mixed models on the outcome variable of individual consumption. Each model is given a name and the predictors included are described in detail in each case. Model numbering is ascending in model complexity in the first number, and descending in the second. For example, Model 2 is more complex than Model 1, but Model 3.1 is more parsimonious than Model 3.

Models are numbered such that the first number ascends with increasing model complexity, while the second number ascends with decreasing model complexity. In other words, each group of models that share the same first number is more complex than the preceding group of models. However, within every group, each iteration corresponds to the removal of redundant predictors. Complexity is increased due to the addition of predictors in line with theoretical

expectations discussed in Section 6.2.3. Simultaneously, with each iteration which adds complexity, statistical tests are used to establish the extent to which inclusion of some predictors are supported by the data. This allows to build a good balance between alignment with the theoretical and conceptual background of this thesis, and the construction of as parsimonious a model as possible.

Model name	**AIC**	**BIC**	**LR-test p-value**	**Compared with**
Comparison 0				
Baseline	34714.67	34741.78		
Treatment	34712.68	34746.57	0.066	Baseline
Comparison 1				
Baseline	34714.67	34741.78		
Model 1	33359.74	33454.63	0.000	Baseline
Model 1.1	33354.44	33442.55	0.842	**Model 1**
Comparison 2				
Baseline	34714.67	34741.78		
Model 1.1	33354.44	33442.55	0.000	Baseline
Model 2	33358.19	33527.58	0.001	Model 1.1
Model 2.1	33341.58	33477.11	0.895	**Model 2**
Model 2.2	33337.36	33466.12	0.889	**Model 2.1**
Comparison 3				
Baseline	34714.67	34741.78		
Model 2.2	33337.36	33466.12	0.000	Baseline
Model 3	33376.36	33552.52	0.000	Model 2.2
Model 3.1	33360.74	33523.36	0.605	**Model 3**
Model 3.2	33349.60	33505.45	0.987	**Model 3.1**
Comparison 4				
Baseline	34714.67	34741.78	0.000	
Model 1.1	33354.44	33442.55	0.000	Baseline
Model 2.2	33337.36	33466.12	0.000	Model 1.1
Model 3.2	33349.60	33505.45	0.000	Model 2.2

Table 40. Likelihood ratio tests and information criteria for model comparisons. The table shows the model name, AIC and BIC, together with the LR test p-value and the model with respect to which the comparison takes place, shown in the rightmost column. For each model pair on which LR tests were carried, the complex model is shown in bold.

This is an important consideration when looking at LR tests, since they test whether increased complexity results in a significantly better fitting model to justify it. In other words, a significant p-value implies that the more complex model shows better enough fit than the simpler reference model to justify the decrease in parsimony. For each row in Table 40, the most complex model out of the two being compared through an LR test is shown in bold. Therefore, a significant

p-value always supports the model shown in bold, while a non-significant one supports the simpler, non-bold model. Information criteria, AIC and BIC operate such that smaller values signify better fit.

Comparison 0 in Table 40 shows that the treatment-only model was not substantially better than the intercept-only model according to an LR test. BIC agreed with this but by a small margin, while AIC did show infinitesimal improvement of including the treatment variable. An F-test further revealed that the treatment variable in this model is non-significant (p-value= 0.07). In light of this, the baseline (intercept-only) model was used as the 'null' model for further comparison.

Comparison 1 supports the inclusion of experimental parameters, demographics and cluster means, as all tests agreed that this improved model fit relative to the baseline model. An F-test on the joint significance of cluster means for age and gender in Model 1 was non-significant (p-value= 0.09), suggesting that the cluster mean for age could be redundant. Model 1.1 tests the simpler model and showed that inclusion of the cluster mean age did not improve model fit significantly enough to warrant its inclusion. All of the tests (LR, AIC and BIC) agreed that the removal of this cluster mean was beneficial to model fit, according to the data.

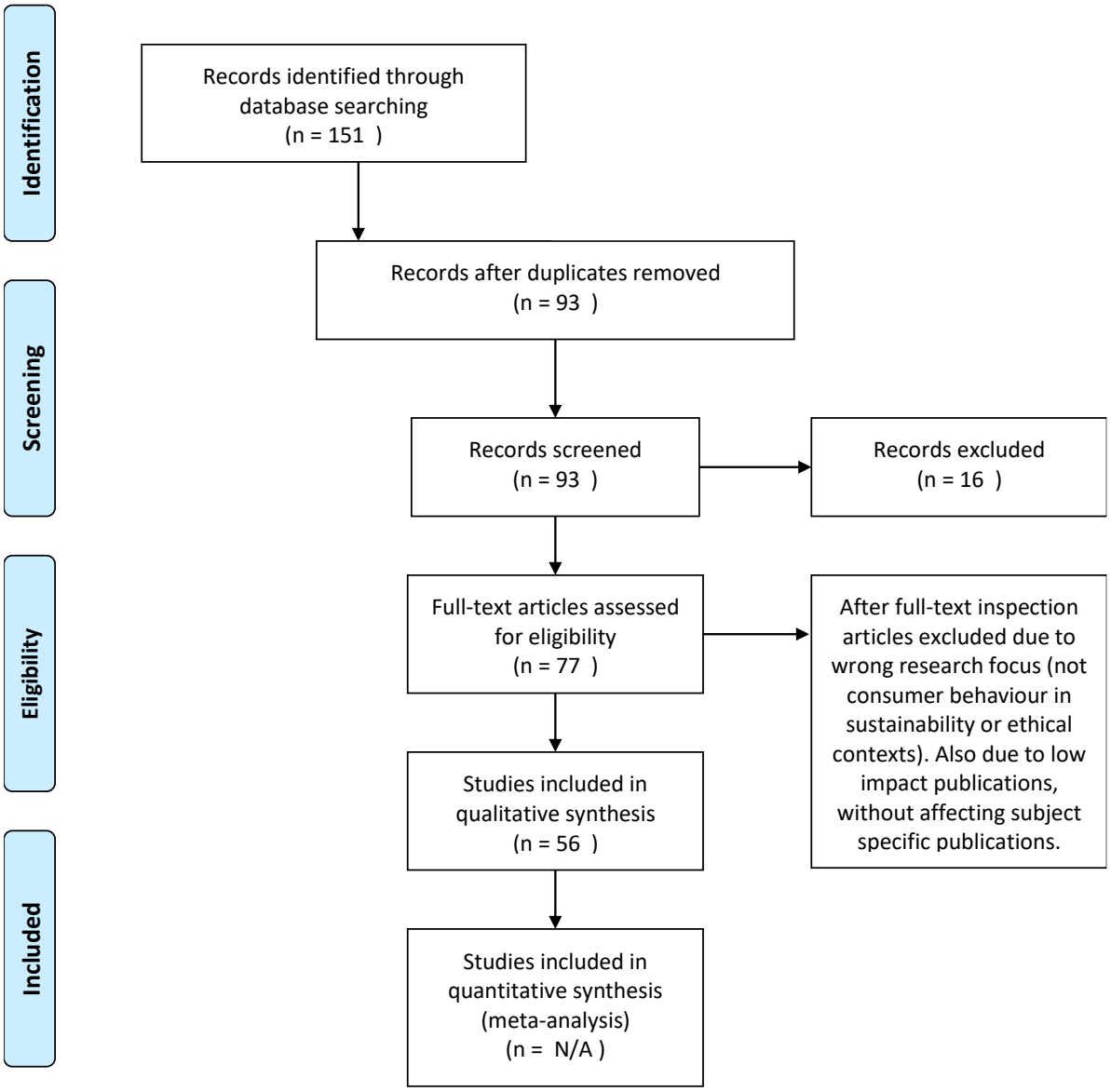
Comparison 2 supported the inclusion of psychological self-reported factors and their cluster means through LR test, but AIC and BIC did not (see Model 2 vs. Model 1.1 in Table 40). However, this could have been expected given that there were many self-reported factors and their cluster means, many of which were highly non-significant. The joint significance of the cluster means that were included was not supported by the F-test (p-value=0.36). Therefore, the model required further refinement. This is what Model 2.1 aimed to achieve by removing all cluster means except for gender and risk aversion, whose joint significance was supported by F-test (p-value=0.04). Up to Model 2.2, the BISUST factor had been maintained due to its relevance to the research design. However, it was consistently highly non-significant and removed at this point. All of LR tests, AIC and BIC supported both the removal of the cluster means that were removed from Model 2 to Model 2.1, and the removal of BISUST from Model 2.1 to Model 2.2. Going back to checking AIC and BIC of Model 2.2 and Model 1.1 (see for example Comparison 4 where this is made more explicit), now the former is supported by both AIC and LR test, but supposedly still marginally worse with respect to BIC. Given the high significance of the LR test and the marginality of BIC difference, together with the F-test performed on the remaining cluster mean

items, these results are taken to support the more complex model (2.2 in Table 40). In other words, cluster means for others' consumption, gender and risk aversion are retained.

Comparison 3 suggests that inclusion of interaction terms between others' consumption and psychological and demographic factors is supported by LR test, however AIC and BIC values are significantly larger, implying a need to refine the included predictors. An F-test did not support the joint significance of the interaction term between others' consumption and risk aversion nor age. Removing these resulted in Model 3.1, which is shown to perform better than Model 3 based on all criteria. Model 3.2 was used to test whether the removal of the interaction term involving external intentions (BIRED) improved model fit substantially. All tests suggested a significant improvement from Model 3.2 relative to Model 3.

Comparison 4 serves to provide a broad look at how theoretically inspired complexity outperforms the simplicity of previous models, where associated predictors are not included. All models outperform the intercept-only model based on all criteria applied. LR tests supported all of the additions: experimental parameters, self-reported factors, cluster means, and interaction terms. In terms of AIC and BIC, the agreement is not widespread, for example going from Model 1.1 to Model 2.2, BIC for the former model is slightly lower. Similarly, from Model 2.2 to Model 3.2, LR test suggests highly significant improvement, but AIC and BIC have slightly higher values. It is worth mentioning that on refinement of Model 3 into Model 3.2, the AIC and BIC difference with Model 2.2 was very significantly reduced. Since the goal of this analysis is not to only infer model selection based on statistical tests, but to achieve an optimal parsimony-content-fit balance, Model 3.2 was deemed the most suitable and subsequently reported in this Thesis (Chapter 6).

Appendix H: Prisma 2009 flow diagram[14]



[14] *From:* Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). *P*referred *R*eporting *I*tems for *S*ystematic Reviews and *M*eta-*A*nalyses: The PRISMA Statement. PLoS Med 6(6): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit www.prisma-statement.org.

Abbreviations

α – Cronbach's alpha

avgrelconsum – Time-averaged individual consumption relative to others in the group (variable)

AIC – Akaike Information Criterion

AVE – Average Variance Extracted

BIC – Bayesian Information Criterion

BIRED – Intentions to consume less

BISUST – Intentions to consume more sustainably

CE – Circular Economy

CFA – Confirmatory Factor Analysis

CFI – Comparative Fit index

CLT – Construal Level Theory

CR – Composite Reliability/ Construct Reliability

DSC – Dispositions toward Sustainable Consumption

EC – European Commission

EFA – Exploratory Factor Analysis

EGD – European Green Deal

FEM – Gender/The gender variable in models (coded as 1=female, 0 =male)

IBG – Intentions-behaviour gap

INT – Intentions to consume selfishly within the Armageddon game (i.e. concrete intentions)

LR – Likelihood Ratio

MLM - Robust maximum-likelihood (R-package *lavaan* nomenclature)

PD – Psychological distance/Psychological distance to climate change

RMSEA – Root mean squared error of approximation

RA – Risk aversion

SCB – Sustainable consumer behaviour/sustainable consumption behaviour

SEM – Structural Equation Model/Structural Equation Modelling

SRMR – Standardized root mean square residual

TLI – Tucker-Lewis index

TPB – Theory of Planned Behaviour

WLSMV - Weighted least squares with robust standard errors and μ- and σ^2-adjusted test statistics

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