School of Population Health

Mixed Methods Investigation of a Pro-environmental Behaviour: The Case of Reusable Coffee Cups

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Declaration

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgement has been made.

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

The research presented and reported in this thesis was conducted in accordance with the National Health and Medical Research Council National Statement on Ethical Conduct in Human Research (2007) – updated March 2014. The proposed research study received human research ethics approval from the Curtin University Human Research Ethics Committee (EC00262), Approval Numbers HRE2017-0173 & HRE2018-0739).

Signature:

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Dedication

I dedicate this thesis to my dad, Andrey. You passed away three weeks before I am submitting this and it is heartbreaking. But I know you were and still are so proud of me for doing this, for walking the academic path just like you did. And I know you are very happy that I am here and wouldn't wish anything else for me. Спасибо, дорогой папа, я всегда тебя буду любить и помнить.

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We acknowledge that Curtin University works across hundreds of traditional lands and custodial groups in Australia, and with First Nations people around the globe. We wish to pay our deepest respects to their ancestors and members of their communities, past, present, and to their emerging leaders. Our passion and commitment to work with all Australians and peoples from across the world, including our First Nations peoples are at the core of the work we do, reflective of our institutions' values and commitment to our role as leaders in the Reconciliation space in Australia.

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Abstract

The problem of plastic pollution cannot be overlooked in this day and age. With 'The Great Pacific Garbage Patch' floating in the ocean the problem is manifesting on a global level. However, we, as individuals, are able to produce change if we address some of our everyday behaviours that might be contributing to the problem, such as overconsumption. Principles of behaviour change within psychological science should be applied to establishing behaviours that are beneficial for the environment, such as recycling, reusing and reducing consumption, which can result in decrease in the amount of waste generated. In order to investigate how it is possible to encourage subtle but important changes in behaviour that reduce the usage of single-use plastics a relatively simple behaviour of using a reusable hot drink cup for take-away drinks was chosen. As using a reusable cup is a behaviour that occurs quite frequently in our everyday life, this behaviour was chosen as a potential model for understanding the relationship between habit formation and pro-environmental behaviour, where habit relates to things we do automatically, without thinking.

The overarching aim of this PhD thesis was to understand the relationship between habit formation and the behaviour of using a reusable hot drink cup, as well as attempt to establish effective ways to change this particular pro-environmental behaviour. The project consists of two distinct phases, which reflect 1) understanding of the potential factors underlying the use of reusable cup and 2) implementation and evaluation of a behaviour change intervention to change that behaviour.

In the first study of phase one, an investigation was conducted as to whether habit, along with other psychological variables, is predictive of the behaviour of using a reusable hot drink cup, using a prospective design. Constructs such as values towards the environment and intention to use a reusable cup were the most significant factors in predicting the use of a reusable cup ($n = 270$). Within the second study of phase one qualitative semi-structured interviews with experts ($n = 11$) in the field of habit psychology as well as consumers ($n = 23$) were conducted, to understand how each group conceptualises habit and whether the conceptualisations differ.

In phase two of this PhD project, the important predictors of using a reusable cup, identified in phase one, were tested, as drivers of behaviour change for increasing the use of reusable cups. In study three a behaviour change intervention to initiate and maintain the use of a reusable cup was developed and implemented ($n =$

156). It had three treatment conditions, based on 1) values towards the environment, 2) intention to use a reusable cup and 3) principles of habit formation, and a control condition. It was found that participants in all the intervention conditions increased their use of a reusable cup compared to the control group, and did so through the mechanism of habit strength. In study one the relationship between a number of personality traits (conscientiousness, need for structure and intolerance for uncertainty), habit and behaviour were explored. Those traits are connected with worry, and worry about the future of the planet can encourage performance of pro-environmental behaviours. It was found that habit strength moderates the relationship between intolerance of uncertainty and the use of a reusable cup. Specifically, the relationship between intolerance of uncertainty and use of a reusable cup was stronger for people with stronger habits. In study four, the second study of phase two, the acceptability of the intervention was evaluated using a mixed methods approach (n = 156). It was well received by the participants with useful feedback provided for future developments.

The key implications of this research include the importance of developing tailored interventions for lasting behaviour change in pro-environmental behaviours. Further research is needed to be able to generalise the findings to a broader array of behaviours.

Author's Note

The current thesis is presented in a hybrid format and consists of four separate papers. Each paper is either submitted for publication or published. As the papers are considered standalone pieces of work, repetition in literature reviews and description of methodology are inevitable. However, efforts were made to reduce overlap and repetition within the papers and the general Introduction and Discussion chapters of the thesis. Each of the four chapters that represent separate studies is preceded by a short paragraph connecting it with the previous chapters. Reference lists have been combined and are presented at the end of the thesis.

Publications Included as Part of the Hybrid Thesis

1. **Novoradovskaya, E.,** Mullan, B., Hasking, P., & Uren, H. (2021). My Cup of Tea: Behaviour Change Intervention to Promote Use of Reusable Hot Drink Cups. *Journal of Cleaner Production*, *284*, 124675. https://doi.org/10.1016/j.jclepro.2020.124675

2. **Novoradovskaya, E.,** Mullan, B., & Hasking, P. (2020). Choose to Reuse: Predictors of Using a Reusable Hot Drink Cup. *Journal of Consumer Behaviour, 19,* 608-617. https://doi.org/10.1002/cb.1834

3. **Novoradovskaya, E.,** Mullan, B., & Hasking, P. (Submitted). What is Habit? Comparison of Lay People's Views and Experts' Opinions.

4. **Novoradovskaya, E.,** Mullan, B., & Hasking, P. (Submitted). Acceptability of a Behaviour Change Intervention Aimed at Increasing the Use of a Reusable Hot Drink Cup.

Conference Presentations

1. **Novoradovskaya, E.,** Mullan, B., & Hasking, P. (2019). Choose to Reuse: Predictors of Using a Reusable Hot Drink Cup. *Society of Australasian Social Psychologists Conference*. (Australia)

2. **Novoradovskaya, E.,** Mullan, B., & Hasking, P. (2018). Habits and Recycling: How to Build Better Practices around Takeaway Drinks. *Dennis Glencross Memorial Seminar.* (Australia)

3. **Novoradovskaya, E.,** Mullan, B., & Hasking, P. (2018). Habits and Recycling: How to Build Better Practices around Takeaway Drinks. *Mark Liveris Research Student Seminar*. (Australia)

4. Bartle, T., Mullan, B., **Novoradovskaya, E.,** Allom, V., & Hasking, P. (2017). Paradox of Choice in the Process of Habit Formation. *Behaviour Change Interventions for Health Habits Conference.* (USA)

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Chapter 1. Introduction

In recent years, it has become impossible to deny the onset of environmental problems connected to anthropocentric influences. A big issue, that has been dominating scientific enquiries and appeared on covers of major media sources, such as National Geographic, is the issue of waste management; big debris of plastic waste are found on remote islands (Lavers et al., 2019), floating in the ocean (Lebreton et al., 2018) and even in bodies of animals and humans (Barboza et al., 2018). Even though action is required from policy makers and big corporations, the behaviours of each individual can positively affect global processes. One of the possible solutions to the problem lies within the everyday behaviours of individuals (Burchell & Riley, 2012; Gardner & Stern, 2008; Koger & Winter, 2011; Steel, 1996; Vlek & Steg, 2007). Such behaviours can include proper recycling and reusing (using items more than once). Changes in these everyday behaviours have the potential to assist in reducing the harmful effects our way of life has on the environment, such as air and water pollution and overuse of single-use plastics and excessive packaging.

Single-use Plastics: the Problem of Disposable Coffee Cups

We can engage in Pro-environmental behaviours in our everyday lives, which are those that cause as little harm as possible to the natural environment around us, or even benefit it (Steg & Vlek, 2009). These consist of a very wide array of behaviours, including recycling, reusing, and upcycling. Many believe that individual pro-environmental actions cannot solve such catastrophic problems as global pollution. However, scientific research suggests otherwise: individual behaviours can and should be changed to more pro-environmental ones to be create a more sustainable future (Bleys et al., 2018; Gardner & Stern, 2008; Koger & Winter, 2011; Vlek & Steg, 2007). Reducing the amount of waste we create is one of the ways to help decrease the contamination of oceans and overflow of landfills. Making shifts in our everyday actions to reduce waste, such as utilising reusable drinking vessels for our take-away coffees, can ultimately lead to the world being a cleaner place. Busy lifestyles and vibrant café cultures mean that the use of takeaway food and drinks is on the rise (Ferreira & Ferreira, 2018), creating a large amount of waste from disposable containers (Gallego-Schmid et al., 2019). A very common belief is that single-use containers such as paper cups are made of paper (as implied in their name) and so belong in the recycling bin and do not end up in landfill. This is, however, not

true, as the cups are usually covered with a thin layer of plastic on the inside of a cup to prevent them from leaking (Maye et al., 2019). Cups, thus, cannot go into general recycling, and end up in landfills. Worldwide, about 16 billion single-use cups end up in the garbage every year (Suskevice & Grönman, 2019). Currently there are more and more biodegradable alternatives on the market, where single-use cups are made of materials that allow them to decompose faster and with less harm to the environment. However, these cups need to be recycled separately and require more resources to be produced, leaving pollution rates still high (Changwichan & Gheewala, 2020). There are a growing number of companies and businesses offering reusable alternatives, which range in price, design and functionality. However, efforts to increase the use of reusable containers for takeaway drinks have also been largely halted by the declaration of the COVID-19 pandemic in 2020, when reusable containers were deemed to increase the transmission of the virus and thus were widely abandoned (Prata et al., 2020; Shah, 2020). It is now more important than ever to apply scientific knowledge to foster positive behaviour change to counteract the devastating effects of the consequences of the pandemic on the environment.

This thesis is largely concentrated around the single, relatively simple behaviour of using a reusable coffee cup, which is crucial to reduction of disposable cup waste. Reusable cups are usually made out of durable plastic, glass or metal and have a lid. They are one of the alternatives to purchasing a drink in a paper cup: they can be relatively cheap (from $10AUD), personalised, easily washed and stored. Often a discount is also offered when purchasing a drink in your own cup. For some however it can be difficult to remember to wash the cup and bring it with you, because it requires extra effort and you can always pay extra and get a paper cup. Some places have implemented a deposit cup scheme, which offers customers the option to get a reusable cup for a small deposit (e.g., $5AUD) and to either keep using it or return it to the store to get the deposit back, which can be a solution when the cup is forgotten at home (Poortinga et al., 2019). However, those systems are rare and paper cups are still sold along with the deposit scheme cups.

The behaviour of using a reusable cup has not been vastly explored in terms of predictors of this behaviour, or interventions aimed at changing the behaviour. The most prominent work to date is by Poortinga and Whitaker (2018), who implemented a large-scale intervention at several university campuses and office buildings in the

UK. The main strategies used were hanging posters with information about reusable cups, substituting the discount on bringing your own cup with an equal charge when purchasing a drink in a paper cup, and providing reusable cups for purchase in the cafes or giving them out for free to customers. All the applied techniques demonstrated effectiveness in increasing the use of reusable cups, however, changing the discount to a charge was deemed most efficient. This intervention provided compelling evidence that large scale policy changes, such as introducing a charge for a paper cup, provision of reusable alternatives and effective information strategies, could reduce waste that is created by discarding paper cups. However, while policies change slowly, individual behaviour change interventions are needed to increase such pro-environmental behaviours and there is a potential for spill-over effect to other pro-environmental behaviours (Nilsson et al., 2017).

Predictors of Pro-environmental Behaviours

With a lack of predictive and intervention studies addressing the specific behaviour of using a reusable hot drink cup, factors relevant to increasing this behaviour may be identified through research on other pro-environmental behaviours. Pro-environmental behaviours have been studied quite extensively within psychology, with a number of main predictors having been identified. Several reviews have been conducted (Bamberg & Möser, 2007; Gifford & Nilsson, 2014; Hines et al., 1987; Steg & Vlek, 2009) to systematically examine the strongest predictors of pro-environmental intention and behaviour, with one of the reviews identifying a complex interaction of 18 different personal and social factors, such as knowledge and education, values, norms, and political orientations among others (Gifford & Nilsson, 2014).

In an integrative review, Steg and Vlek (2009) identified five main categories of predictive factors that underlie a broad array of pro-environmental behaviours: moral and normative concerns, affect, contextual factors, habits, and perceived costs and benefits. Moral and normative concerns include values toward the environment, concern for the state of the environment, moral obligations to act in a pro-environmental manner, and social norms of pro-environmental behaviour being approved or disapproved of by others (Steg, Bolderdijk, et al., 2014; Whitmarsh & O'Neill, 2010). Affect reflects the emotional response that a behaviour can elicit within an individual. Affect is associated with status, which is dominant, for example,

in car use (Steg, 2005). Contextual factors refer to the environmental surroundings, such as availability of recycling facilities or presence of cycling lanes for safe active commuting. Habits refer to those behaviours that we do automatically, without thinking, such as turning off the lights when leaving the room, or heading to the garage to start your car when the time to go to work comes. Habitual behaviour is explored within pro-environmental behaviours and has demonstrated predictive capacity in, for example, travel mode choice (Gardner, 2009; Hoffmann et al., 2017). Perceived costs and benefits as a motivational factor are usually reflected in the application of components of the theory of planned behaviour (Ajzen, 1991). This theory has been used broadly to predict a wide variety of pro-environmental behaviours, finding its components to be important for such behaviours as commute mode choice, recycling, composting, energy saving and others (Steg & Vlek, 2009).

Intention, as the main component of the theory of planned behaviour, plays a strong role in the explanation of variance in pro-environmental behaviour (Blok et al., 2015; Maki et al., 2019), and as a mediator between psycho-social variables and behaviour (Bamberg & Möser, 2007). As such, intention to engage in reusable drink cup use is a potentially important factor in predicting this behaviour. However, in psychology the 'intention-behaviour gap' is well documented (Godin et al., 2005; Sheeran, 2002; Sniehotta et al., 2005; Webb & Sheeran, 2006): it occurs when intention does not directly translate to behaviour. If intention to perform a behaviour perfectly predicted its subsequent performance, there would be no intention-behaviour gap. Variables that help bridge the intention-behaviour gap have not been explored extensively within pro-environmental behaviours. However, in other behaviours, planning, self-efficacy and action control were shown to be useful (in physical activity; Sniehotta et al., 2005), as have moral norms (in a range of behaviours, including smoking, safe driving and exercising; Godin et al., 2005) and habit (sunscreen use; Allom et al., 2013). Within pro-environmental behaviours habit is also a promising component that may help bridge intention and behaviour, as mentioned above (Klöckner, 2013; Verplanken et al., 1998).

It is important to understand which factors are essential for pro-environmental behaviours in general. However, investigating antecedents of specific behaviours, such as using a reusable cup, has practical significance in producing real-world change.

Interventions to Promote Pro-environmental Behaviours

In recent years a shift has been happening in the way pro-environmental behaviours have been promoted. Since the problems of climate change and pollution are becoming more and more prominent, some policies have been changing on national levels, such as bans on free single-use plastic bags in grocery shops or restrictions on use of plastic straws for drinks. Some countries claim that within the next few years most single-use plastics will be banned, creating a large-scale behaviour change (European Parliament, 2019, March 27; The Government of Western Australia, 2020, November 12). Unfortunately, policies do not change very fast, hence smaller scale behaviour change interventions need to be implemented so individuals can start to adopt pro-environmental behaviours as soon as possible. Various interventions have been tested and have demonstrated effectiveness in changing pro-environmental behaviours. For example, a meta-analysis consisting of 70 interventions aimed at increasing rates of recycling demonstrated that social modelling and contextual changes are the most effective strategies (Varotto & Spagnolli, 2017). The authors recommend incorporating norms, values, and habits in future intervention developments. The authors note, however, that some of the important predictors of recycling behaviours are under-utilised within interventions, such as attitudes, or tailoring interventions to personality traits and demographic characteristics. The long-term effects of interventions are also largely under-investigated.

A review of interventions aimed at energy saving within households demonstrated that providing feedback on behaviour, gamification of the process, setting goals, and community-based initiatives are the most effective interventions strategies to reduce energy consumption (Iweka et al., 2019). A systematic review and meta-analysis of interventions to decrease car use and increase active commuting (by bicycle, for example) revealed no significant decrease in car use (Arnott et al., 2014). However, the effective strategies in individual studies seem to be a combination of providing information and behavioural regulation techniques (for example, goal-setting or identification of barriers). From these reviews it is evident that, apart from information provision and goal-setting, there is little consensus on what constructs should be targeted within behaviour change interventions aimed at

changing pro-environmental behaviours at large, and specific behaviours such as using a reusable cup.

Habits and Pro-environmental Behaviours

Habits, as one of the important predictors of pro-environmental behaviours, have demonstrated promising results when targeted within behaviour change interventions (Gardner & Rebar, 2019). Habit is generally defined as an implicit association, learned through repetition, triggered by a salient feature of a stable context and rewarded at least in the initial stages (Orbell & Verplanken, 2010). Generally, habit is considered an implicit process, one of the possible determinants of behaviour, which may or may not result in habitual behaviour (Gardner, 2015). Habit consists of three main components that play a crucial role in the process of habit formation and in the functioning of habit: a stable context, cues, and rewards (Gardner, 2015; Wood & Rünger, 2016). Habits are usually performed in a relatively stable context, hence a lot of our everyday behaviours are habitual. A cue is a trigger for habit and is a salient feature of the stable context. For example, going to see a movie (stable context of a movie theatre) and smelling the popcorn (cue) can trigger us to buy and eat some (taste of popcorn is a reward), however, watching a movie at home and not having the smell of popcorn as a feature of the context may not result in us eating popcorn. Reward is essential for a habit to form, however it can lose its significance once a habit is well established. The great taste of popcorn is a reward that we get for having a habit of buying it at the movies, however, in an interesting experiment (Neal et al., 2012), it was shown that the reward of taste might lose its importance over time. Habitual consumers of popcorn ate as much stale popcorn as they did fresh. This highlights that reward may be important to establish a habit but may not be necessary at the maintenance stage of habitual behaviour, where we can act habitually even in the absence of reward.

Habitual behaviours differ from intentional behaviours in the level of cognitive resources needed to perform these, as well as, at times, in the level of awareness. According to dual-process models (Evans & Stanovich, 2013; Hoffmann et al., 2017; Wood & Rünger, 2016) there are intentional (slow, deliberate) and impulsive (fast, unconscious) processes that underlie our behaviour. Intentional processes (such as intention) require more cognitive energy, whereas impulsive processes (such as habit) help us save cognitive energy by running behaviour 'on

autopilot'. When we are tired we are more likely to engage in impulsive processes that require less cognitive energy. Thus habit, as an impulsive process, is a powerful mechanism that can help us to engage in more beneficial behaviours without spending cognitive energy on them (e.g., automatically reach for reusable cup when buying a coffee).

Several habit-based interventions have demonstrated effectiveness in increasing pro-environmental behaviours. The 'habit discontinuity hypothesis', which postulates that behaviour is easier to change in transitional phases of life, was tested within an experiment by Verplanken and Roy (2016); habit was easier to break, and new habits easier to form when context disruption was observed (moving house). In another study (Comber & Thieme, 2013), cameras installed on the inside of recycling bin lids provided feedback on actual recycling behaviours to the participants, increasing awareness of habitual, automatic behaviours. The intervention did not result in significant changes in terms of an increase in recycling, but had an effect on overall waste generation and excessive waste avoidance (e.g., shopping and meal planning to avoid throwing out food and packaging). A study by Holland et al. (2006) introduced contextual changes to the office environment, by providing special bins for paper recycling at employees' desks and counting the amount of paper in the bins by the end of the day, which resulted in a significant increase in recycling behaviours over a two-month period.

It is important to address individual behaviour change in pro-environmental behaviours in order to reduce the harmful effects of waste on the environment. Conducting interventions that are based on theoretical underpinnings and solid evidence can help create frameworks for potentially extrapolating the findings to other pro-environmental behaviours and producing tangible change.

Aims and Thesis Outline

The overarching purpose of this thesis is to investigate the pro-environmental behaviour of using a reusable cup, its predictors and ways to implement effective behaviour change. The aims are:

1. To understand the psychological factors underlying use of a reusable cup.
2. To develop and evaluate an effective behaviour change intervention based on those factors.
3. To explore how the concept of habit can be helpful in changing a pro-environmental behaviour.

The first aim is addressed within the first two studies of the thesis (phase one). The second aim is addressed within phase two of the thesis, which consists of studies three and four. Aim three is reflected throughout the entire body of research. Overall, there are four studies within this thesis, presented in Chapters two through five:

Chapter 2 contains study one of the thesis, where the predictors of a pro-environmental behaviour of using a reusable hot drink cup were explored. This was done to test the first aim of the thesis and identify factors that are important to target in a behaviour change intervention. Values towards the environment, intention to use a reusable cup, strength of habit to use the cup, as well as trait-like characteristics such as conscientiousness, need for structure, and intolerance of uncertainty were investigated for their capacity to explain variance in self-reported use of a reusable cup.

Chapter 3 reports on study two of the thesis. In this study, habit as a potential contributor to change in everyday behaviours was explored. Employing a qualitative methodology, How potential intervention recipients and intervention developers define the concept of habit and how it can be helpful in informing behaviour change interventions based on principles of habit formation was investigated.

Chapter 4 is the central study of the thesis and the first study of phase two. The aim was to develop and implement a behaviour change intervention to increase the use of a reusable hot drink cup. The findings of phase one of the project were utilised, and three intervention conditions were developed, targeting important predictors of the behaviour of using a hot drink cup. The findings of study one informed the development of treatment conditions based on evoking environmental values and intention, and the findings of study two helped in developing an

intervention condition based on principles of habit formation. The control condition was employed to evaluate the findings against a no treatment group over six weeks.

Chapter 5 is the second study of phase two, where the second aim of the project is addressed. In this study the acceptability of the behaviour change intervention, described in Chapter 4, was evaluated using a mixed methods approach. Participants addressed the contents of the intervention and methods of assessing the behaviour of using a reusable cup through survey responses and semi-structured interviews. The researcher's reflections through the process of intervention implementation were also evaluated in order to form recommendations for future interventions and translating the efforts to similar behaviours.

Chapter 6 concludes the thesis with a general discussion of the findings from all four studies, addressing strengths, limitations and implications of the accomplished work.

Chapter 2. Choose to Reuse: Predictors of Using a Reusable Hot Drink Cup

The first study of the phase one of the thesis is dedicated to the exploration of possible predictors of use of a reusable cup. Previously investigated antecedents of pro-environmental behaviours were examined, such as values towards the environment and intention, as well as underexplored constructs, such as habit strength and personality dispositions related to preference for organisation or structure in life, such as conscientiousness, need for structure, and intolerance of uncertainty.

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Author	Contribution	I acknowledge that these represent my contribution to the above research output. Signed:
Elizaveta Novoradovskaya	Conceptualisation, Methodology, Data Analysis, Investigation, Data Curation, Writing, Project administration	
Barbara Mullan	Assisted in Conceptualization, Methodology, Writing - Review & Editing, Supervision.	
Penelope Hasking	Assisted in Conceptualization, Methodology, Writing - Review & Editing, Supervision	

Abstract

Sustainable behaviours are important for the future of the planet. Exploring the psychological predictors of those behaviours can assist in developing efficient and cost-effective interventions for people to acquire and maintain them. I explored potential predictors of using a reusable hot drink cup. Students and staff ($n = 270$) from a number of Australian universities answered questions addressing their past behaviour, intention to use a reusable cup, habit automaticity, intolerance of uncertainty, need for structure, conscientiousness, and environmental values. One week later, participants retrospectively reported use of their reusable cup over the previous week. Results demonstrated that past behaviour and strength of environmental values significantly predicted the use of the cup. A trend was found for people unable to withstand uncertainty, where stronger habits were associated with greater use of the cup. These results can contribute to development of evidence-based behaviour change interventions.

Introduction

Recent years have been noticeably marked by raising awareness and debate about the problem of climate change. Latest news reports and scientific findings indicate that there are tonnes of plastic waste found even on the remote Cocos islands off the coast of Australia (Khan, 2019; Lavers et al., 2019), as well as on the islands of the Gulf of Carpentaria (Heathcote, 2019). The majority of waste consists of everyday objects that are not being disposed of and/or recycled properly. Contrary to the common belief that the actions of one individual cannot positively affect global processes such as climate change, one of the possible solutions to the problem lies within the everyday behaviours of individual people (Burchell & Riley, 2012; Gardner & Stern, 2008; Koger & Winter, 2011; Schuitema & De Groot, 2015; Steel, 1996; Vlek & Steg, 2007), for example, proper recycling, active commuting (choosing walking or cycling instead of using a car), responsible consumption or energy and water saving. Thus, more attention has been dedicated to understanding the mechanisms that underlie everyday pro-environmental behaviours and ways to enact behaviour change in order to improve environmental actions (Steg & Vlek, 2009).

Drinking coffee is a part of everyday routine for many Australians (Fredholm et al., 1999). With the modern 'on-the-go' lifestyle, it is not a surprise that a large amount of coffee is bought to takeaway and it is estimated that around one billion disposable cups are being used in Australia each year (Whyte, 2016). Around 90% of those cups end up in landfill, and as the majority of them are covered in a thin polyethylene film on the inside to prevent leakage (Ziada, 2009), they cannot be properly recycled.

One of the possible solutions to this problem is using a reusable hot drink cup when purchasing takeaway beverages, which would reduce landfill (Hansen et al., 2002; Poortinga et al., 2019; Poortinga & Whitaker, 2018). There are a number of big reusable cups producers in Australia, such as KeepCup™ (https://au.keepcup.com/) that provide cups made of various materials (plastic, glass, metal) and with various designs, or Frank Green™ (https://frankgreen.com.au/), who offer cups with a microchip, allowing people to pay in stores for the purchase of coffee (acting like an EFTPOS card). The use of reusable cups has increased in the past years, however, the problem of disposable cups remains, as paper cups are still being offered for the sale

of takeaway drinks. Increasing the use of reusable cups in Australia can reduce the amount of landfill waste and positively affect the environment.

Literature Review

Individual behaviours that impact climate change, and active steps that can be taken in order to reduce their impact on the environment, were outlined by Gardner and Stern (2008), and are mainly related to active commuting and energy saving in households. A growing body of work is exploring why people do or do not engage in these behaviours from a psychological perspective, and what can assist people in achieving change (Barr, 2007; Gardner, 2009; Hoffmann et al., 2017; Kothe et al., 2019; Verplanken et al., 1998). In order to better understand which factors are associated with engagement in pro-environmental behaviours, it is important to recognise the strongest predictors of behaviour in general. There have been a number of research studies that address the predictors of our everyday behaviours. For instance, past behaviour has been found to be one of the strongest predictors of future behaviour: the more we perform a certain action, the more likely we are to repeat it (e.g. Ajzen, 2002b; Ouellette & Wood, 1998). Intention to engage in a behaviour is also largely responsible for enactment of behaviour, however, an intention-behaviour gap (where intention cannot fully predict or fails to predict behaviour) is well documented (Godin et al., 2005; Rettie et al., 2014; Sheeran, 2002; Sniehotta et al., 2005; Webb & Sheeran, 2006). Yet, if a behaviour is habitual, the intention-behaviour gap is reduced. The strength of habit is one of the factors proposed to assist in bridging the gap between intention and behaviour (Gardner et al., 2011). A good explanation of the possible complementarity of intention and habit is offered by dual-process theories, where deliberative, intentional processes (e.g., intention to engage in a behaviour) coexist with automatic, habitual processes (e.g., habits) and both underlie behaviour (Evans & Stanovich, 2013; Hofmann et al., 2009; Strack & Deutsch, 2004; Wood & Rünger, 2016). Intentional processes assist in decision making and solving of difficult or novel tasks, whereas impulsive processes help conserve cognitive capacity and allow us to perform complex actions with less effort.

Habit, being an automaticity-based process, as well as one of the influential determinants of behaviour (Danner et al., 2008; De Bruijn et al., 2007; Verplanken, 2018), represents a pattern of action that is learned through repetition in a stable environmental context. It is triggered by a salient feature of the context and, in the

early stages of habit formation, is followed by a reward (Orbell & Verplanken, 2010). Although many habits might be considered unhealthy (for example, smoking, unhealthy snacking, driving a car for short trips etc.), it would be advantageous if we could harness the power of impulsive processes to foster good habits. For instance, if we could automatically use our bicycles to go to work, bring our reusable bags to the supermarket, or choose an apple instead of chocolate, it would be of benefit to our own health, the environment, and our cognitive capacity. The majority of behaviours that adversely impact climate change and the environment tend to be habitual in nature: driving to work, taking a long shower in the morning, putting all the rubbish in the same bin etc. Even if we decide to switch to a more pro-environmental, healthier alternative, such as cycling to work, we might initially find ourselves automatically getting in the car when the time to leave for work comes.

The application of habit theory to pro-environmental behaviours has demonstrated the importance of habit as a predictor of behaviour. Habit, along with intention, has been found to be associated with such environmental behaviours, as a choice of alternative transport mode (Hoffmann et al., 2017), use of car or bicycle to commute (Gardner, 2009), general recycling (Comber & Thieme, 2013), and workplace paper recycling (Holland et al., 2006). Specifically, in situations that happen in an unchanging context, where habit is aligned with intention, strong habit may override motivational components, as no additional cognitive processes are needed (Gardner, 2009; Verplanken et al., 1998). For example, when intending to ride a bicycle to work, habit of getting in the car wins out before you realise it.

Another way of addressing the 'intention-behaviour gap' is to explore personality traits and more stable trait-like dispositions as possible factors adding to the explanation of behaviour. Although little research has explored individual differences in personality traits in relation to environmental behaviours, there are studies that have found an association between personality dispositions and habitual behaviours (e.g., in health; see Monds et al., 2016). In relation to pro-environmental behaviours, the Big Five (Digman, 1990) personality traits, conscientiousness, agreeableness and openness to experience, were linked to general likelihood to perform pro-environmental behaviours (Milfont & Sibley, 2012). A similar pattern was found in a study with adolescents, with intention to recycle and self-reported recycling behaviour being higher for people with high scores on conscientiousness,

agreeableness, extraversion, and openness to experience (Poškus & Žukauskienė, 2017). Further, traits of neuroticism and extraversion were found to have an indirect effect on the habit of using a car (Yazdanpanah & Hadji Hosseinlou, 2017). Conscientiousness was also a significant predictor of self-reported waste management behaviour (Swami et al., 2011).

Conscientiousness, as a trait connected with high levels of self-discipline and preference for organisation in life, is associated with habitual behaviours (Vishwanath, 2015), and can possibly facilitate habit formation (Wood, 2017). People, who prefer certainty and structure, might engage in more habitual behaviours and form them more easily, than more laid-back, spontaneous individuals, who prefer to 'go with the flow'. Thus, forming everyday routines and habits might be a way for highly conscientious individuals to cope with the unpredictability and uncertainty that may inevitably occur in everyday life. Previously, such traits as intolerance of uncertainty and need for structure have been found to have associations with trait conscientiousness (Berenbaum et al., 2008), leaving the question of their possible association with habit open to investigation.

In order for pro-environmental behaviour to become habitual, a specific motivation should be in place, which drives an individual to perform the behaviours intentionally repeatedly, until the habit is formed. Even though some financial initiatives are offered to engage in certain pro-environmental behaviours (e.g. a discount for bringing your own drink container), they show limited effectiveness (e.g. Poortinga & Whitaker, 2018; Tseng, 2016). Consequences of engaging in these behaviours are not immediately tangible (e.g. reduction in landfill is likely to happen in the very distant future), and thus do not provide immediate reward to strengthen the cue-behaviour association (Steg, Perlaviciute, et al., 2014). Motivation behind engaging in pro-environmental behaviours might be intrinsic (van der Werff et al., 2013a). Moreover, stable motivational factors related to the environment, such as values, norms and aspects of identity, are strongly associated with pro-environmental behaviours (Göckeritz et al., 2010; Sparks & Shepherd, 1992; Stern, 1992; Thøgersen & Ölander, 2002; Verplanken & Holland, 2002; Verplanken & Roy, 2016; Whitmarsh & O'Neill, 2010). They can potentially serve as an internal reward for performing pro-environmental behaviours (the good feeling of acting in accordance with one's values), thus assisting in habit formation.

In order to develop successful behaviour change interventions to increase pro-environmental behaviours in everyday life, it is important to understand what underlies those behaviours. The focus of the current study is on the use of a reusable hot drink cup as one of the everyday behaviours that offers a sustainable solution to the use of disposable cups. The aim of the current study was to explore possible predictors of reusable hot drink cup use. We aim to examine variables found to be predictive of habitual behaviours, such as intention to reuse the cup and habit strength, with habit strength moderating the relationship between intention and behaviour. It is hypothesised that intention to use the cup will predict behaviour, but the relationship will be moderated by habit strength, such that the relationship is strengthened among people who have a stronger habit to use a reusable cup. Given the lack of literature in the area, our questions regarding the role of personality constructs, such as conscientiousness, intolerance of uncertainty, and need for structure, along with environmental variables, were exploratory, with the expectation that those with higher scores on the stable dispositions would have stronger habit and behaviour.

Methods

Participants and Procedure

We employed a prospective design, where participants completed a questionnaire assessing psychological variables and a week later completed measures of behaviour. We wanted to recruit students and staff of Australian universities, as a university is a 'closed' system, where people spend a lot of time and may have a preference for certain locations (e.g., cafes or food trucks) (Poortinga & Whitaker, 2018). University outlets and cafes frequently offer reusable cups for sale and discounts on drinks in your own cup, thus providing a good representation for the behaviour of interest.

A total of 582 participants were recruited. Of these 188 were excluded based on not completing the behavioural measure; 55 because of incomplete or incorrect measures. The attrition rate between time 1 and time 2 was 32%, leaving 270 participants who used a reusable cup. Participants were between 17 and 66 years old ($M = 25.55$; $SD = 9.35$) and were predominantly female (77%). Recruitment was performed at a large Australian university, via online recruitment, social media, and snowballing methods. Advertisements inviting student and staff members to take part in a study on the use of a reusable cup were placed digitally on the university's

Facebook page, Facebook student communities, on Twitter (to be shared), on forums (such as Reddit), and as posters and flyers around the campus and coffee outlets. An advertisement was also placed on an online platform, which is used to advertise studies to students wishing to participate in research for course credit. All participants, who completed both questionnaires, received either study points or a chance to win one of four department store gift cards. Participants could access the questionnaire via a link or a QR code and were told that one week after completing the first survey, the second survey would be emailed to them. The survey took only a few minutes to complete. The research was approved by the University's Human Research Ethics Committee (see Appendix 1).

Measures

Demographics. Questions regarding age and gender were asked.

Past behaviour. Participants were asked one question about previous use of a reusable hot drink cup: "Have you ever used a reusable hot drink cup before?" If YES was answered, the participants were asked how often the behaviour had been performed in the past three months from "once or more a day" to "never".

Intention to use a reusable cup. Two questions about intention to use a reusable hot drink cup were asked (Ajzen, 2002a): "I intend to use a reusable cup every day over the next week" and "I plan to use a reusable cup every day over the next week". The answers were on a 7-point Likert scale from "strongly disagree" to "strongly agree".

Self-report habit index (SRHI) (Verplanken & Orbell, 2003). This scale measures habit automaticity, the extent to which the behaviour is habitual. It consists of 12 items that are responded to on a 7-point Likert scale, ranging from "strongly disagree" to "strongly agree". For example, "Using a reusable drink cup is something I do frequently". The final score is the mean of scores. This measure has high internal consistency α = .92 (Verplanken & Orbell, 2003). For this sample the internal consistency is high α = .96.

Conscientiousness scale of the International Personality Item Pool (IPIP) questionnaire (Goldberg et al., 2006). Conscientiousness scale describes the personal need to organize one's surroundings, discipline, accuracy and perfection. It consists of 10 statements, which are evaluated on a 5-point Likert scale regarding how accurately they describe the participant, from "very inaccurate" to "very accurate".

Examples of items: "I am always prepared" or "I make a mess of things". This scale has an internal consistency of α = .75 (Roberts et al., 2005). Internal consistency for this sample is high at α = .84.

 Short version of intolerance of uncertainty scale (Carleton et al., 2007). The scale assesses tendency to expect a negative event to occur independent of the probability of it happening. It consists of 12 items scored on five responses, from "not at all characteristic of me" to "entirely characteristic of me". For example, "Unforeseen events upset me greatly". Scores are summed for a total score. It has an internal consistency of α = .96 (Carleton et al., 2007). The internal consistency for this sample is also high at α = .93.

 Need for structure (Neuberg & Newsom, 1993). The scale reflects preference for simple structure in everyday activities. It consists of 12 items, with answers ranging on a 6-point Likert scale from "strongly disagree" to "strongly agree". Example of items: "It upsets me to go into a situation without knowing what I can expect from it". The sum of scores is used as the total. The internal consistency of the scale is adequate at α = .77 (Neuberg & Newsom, 1993). Internal consistency for this sample is sound α = .84.

 Biospheric values (De Groot & Steg, 2008). The scale consists of four items measuring value orientations towards environmental beliefs. Respondents were asked to evaluate four values on a scale from -1(opposed to this value) to 7(this value is extremely important to me). The values are: respecting the earth; unity with nature; protecting the environment, and preventing pollution. Mean scores represent the overall score. Internal consistency of the scale is α = .83 (De Groot & Steg, 2008). For this sample the internal consistency is high α = .91.

 Personal involvement in relation to the environment (Verplanken & Roy, 2016). The scale assesses personal involvement in relation to environment: interest in the environment, emotional involvement and empowerment. It consists of eight items that are evaluated on 5-point Likert scale, ranging from "strongly disagree" to "strongly agree". For example, "I really worry about things like climate change". A mean score is calculated for the final score. Cronbach's alpha for the scale is α = .81 (Verplanken & Roy, 2016). Internal consistency for this sample is high α = .87.

 Personal norms in relation to the environment (Verplanken & Roy, 2016). Items are rated on 5-point Likert scale from "strongly disagree" to "strongly agree".

For example, "Using a reusable cup is something everyone should do". A mean score is calculated as a final score. Cronbach's alpha varies between α = .78 and α = .84 (Verplanken & Roy, 2016). Internal consistency for this sample is high α = .82.

Adapted version of timeline follow-back (Sobell & Sobell, 1992). The adapted version of the alcohol consumption timeline follow-back was used to measure the use of reusable cups in the past week. Over the 7 day period, participants were asked, in the morning, afternoon, and evening, to report the number of hot drinks consumed and the number of times a reusable cup was used. The overall score was calculated by weighting the percentage of times a reusable cup was used (out of all the times a hot drink was consumed) by the total opportunity to use a reusable cup (out of 21 possible slots – 3 times a day over 7 days – in the timeline follow-back). Test-retest reliability of the measure has generally been good for alcohol consumption ranging from $r = .61$ and $r = .97$ for various populations (Sobell et al., 1986).

Example of the questionnaires can be found in Appendix 2.

Data Analysis

Hierarchical multiple regression was used as the superior method to explain variance in the behaviour of using a reusable cup for each independent variable while accounting for all other variables (Cohen et al., 2013; Hayes, 2005). The use of a reusable hot drink cup was the criterion variable. Predictor variables were entered according to the stability of characteristics. On step one of hierarchical regression age and gender were entered as control variables. At step two trait-like characteristics were entered, including intolerance of uncertainty, conscientiousness, need for structure, and scores on environmental measures. At step three intention to use a reusable cup over the coming week was entered, as intention usually precedes habit in the learning process. At step four habit strength was entered. Step five included interactions between intention and habit strength, as well as interactions between intolerance of uncertainty, need for structure, conscientiousness, environmental values, and habit strength.

All variables (except gender) were standardised before entering into the regression. Simple slopes analysis, using the PROCESS macro for SPSS (Hayes, 2017) was performed for significant interactions at ±1 standard deviation from the mean (Aiken et al., 1991; Dawson, 2014).

Results

There were 339 participants who completed both questionnaires, but only participants who reported using a reusable hot drink cup ($n = 270$) were included in the analysis. Descriptive statistics and bivariate correlations are presented in Table 1. Assumptions of normality and linearity of residuals were tested and met. Assumption of homoscedasticity of residuals was violated; data transformation was applied, however, that did not reduce the mild departures from homoscedasticity of residuals. We made the decision to use the non-transformed data for ease of interpretation.

Sensitivity analysis for current sample was performed with G*Power (Faul et al., 2009). It demonstrated that our sample size of 270 participants was large enough to detect a small to medium effect of Cohen's $f^2 = 0.07$, with power of 0.8 and $\alpha = 0.05$ (Cohen, 2013). Given our observed effect of $f^2 = 0.267$, we were sufficiently powered for this study.

Only one item ("I intend to use a reusable cup every day over the next week") from the two measuring intention was retained for the analysis, as the correlation between the items was very high r (268) = .909, $p < .001$. Given high correlations between variables of biospheric values, personal involvement, and personal norms (see Table 1), a factor analysis was implemented to evaluate whether the three scales have a common underlying factor. Principal axis factoring indicated that these three measures load onto a single factor, accounting for 73.4% of variance in the data. Considering a large number of predictive variables and greater sample size needed for moderated regression analysis, the decision to summate the three measures was made. Internal consistency was high at $\alpha = .93$. After addressing the abovementioned issues, remaining variables were correlated but not enough to indicate multicollinearity (Table 2.1).

Table 2.1 Descriptive analysis of variables: means (*M*), standard deviations (*SD*) and bivariate correlations (Pearson); $N = 270$

Variable	M	*SD*	Age	Intention	Habit strength	Intolerance of uncertainty	Need for structure	Conscientiousness	Biospheric values	Personal involvement	Personal norms	Use of reusable cup
Age	25.55	9.35		.188**	.244***	-.253***	-.048	.203**	.187**	.138*	.132*	.252***
Intention	3.94	2.03			.687***	-.008	.066	.106	.224***	.232***	.387***	.249***
Habit strength	3.72	1.56				.062	.149*	.228***	.211***	.211***	.334***	.258***
Intolerance of uncertainty	31.44	10.37					.655***	.014	.008	.067	.088	-.004
Need for structure	45.6	8.85						.432***	-.049	-.012	.084	-.022
Conscientiousness	34.9	6.64							.112	.068	.096	.067
Biospheric values	5.05	1.47								.773***	.673***	.302***
Personal involvement	3.51	0.76									.746***	.297***
Personal norms	3.78	0.85										.233***
Use of reusable cup	32.16	24.7										

Notes: *** Correlation is significant at $p < 0.001$; ** Correlation significant at $p < 0.01$; *Correlation is significant at $p < 0.05$

At step one of the hierarchical regression age and gender accounted for a significant 7% of variance in behaviour, $R^2 = .068$, $F(2, 267) = 9.76$, $p < .001$, with only age contributing unique variance (Table 2.2). At step two need for structure, environmental values, conscientiousness and intolerance of uncertainty accounted for an additional 8% of the variance in behaviour, $\Delta R^2 = .083$, $\Delta F(4, 263) = 6.39$, $p < .001$, with environmental values contributing unique variance. At step three, intention contributed an additional 2% of the variance, $\Delta R^2 = .021$, $\Delta F(1, 262) = 6.53$, $p = .011$. In step four habit strength was added to the model, accounting for a non-significant 0.5% of variance, $\Delta R^2 = .005$, $\Delta F(1, 261) = 1.49$, $p = .224$. Finally, in step five hypothesised interactions were added to the regression equation, significantly predicting another 4% of the variance explained, $\Delta R^2 = .035$, $\Delta F(5, 256) = 2.26$, $p = .049$, with the interaction between habit strength and intolerance of uncertainty being the only significant contributor ($p = .025$).

Table 2.2 Results of hierarchical multiple regression

Variable	R^2	ΔF	df	B[95% CI]	β
Step 1	.068	9.755**	267		
Gender				-4.07 [-10.89, 2,74]	-.069
Age				6.23 [3.35, 9.11]	.252**
Step 2	.151	6.394**	263		
Intolerance of uncertainty				2.66 [-1.5, 6.82]	.108
Need for structure				-2 [-6.46, 2.46]	-.081
Conscientiousness				.69 [-2.71, 4.09]	.028
Environmental values				6.73 [3.87, 9.61]	.273**
Step 3	.171	6.526*	262		
Intention to use a drink cup				3.76 [.86, 6.65]	.153*
Step 4	.176	1.486	261		
Habit strength				2.41 [-1.48, 6.3]	.098
Step 5	.211	2.255*	256		
Interaction: Intention*habit				-.01 [-3.01, 2.99]	.000
Interaction: habit*intolerance of uncertainty				4.02 [.499, 7.54]	.190*
Interaction: habit*need for structure				-1.45 [-5.74, 2.85]	-.064
Interaction: habit*conscientiousness				-1.94 [-5.34, 1.46]	-.082
Interaction: habit*environmental values				-.98 [-3.59, 1.64]	-.047

Notes: B [95% CI] – non-standardised regression coefficients and 95% confidence intervals; β – standardised regression coefficients; Significance at *$p < .05$

**$p < .001$

We conducted simple slopes analysis using model 1 from the PROCESS macro (Hayes, 2017). As seen in Figure 2.1, there was a positive relationship between intolerance of uncertainty and behaviour at high levels of habit strength $b = 6.09$, t $(270) = 2.17$, $p = .03$, but no relationship at low levels of habit strength, $b = -1.95$, t $(270) = -.071$, $p = .48$.
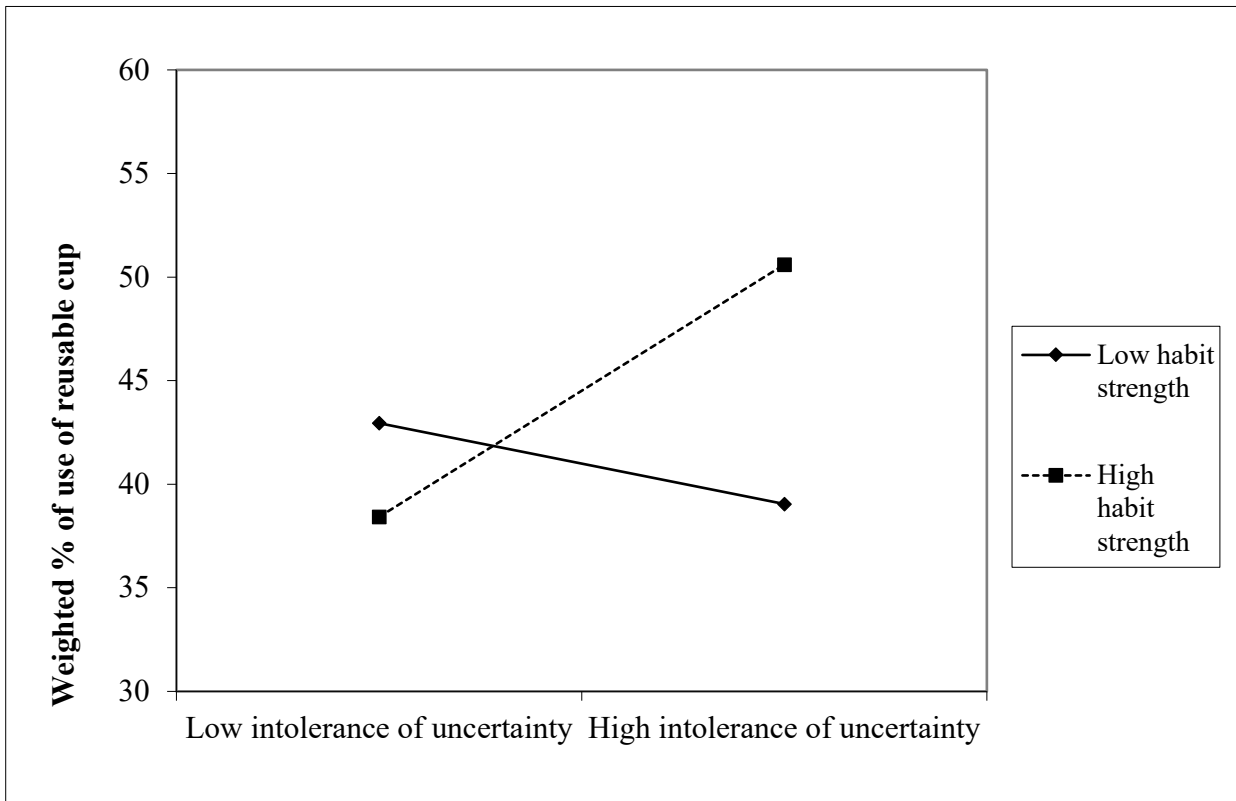
Figure 2.1 Moderating effect of habit strength on relationship between intolerance of uncertainty and behaviour: at high levels of intolerance of uncertainty higher levels of habit strength play a significant role in predicting behaviour.

Discussion

The aim of this prospective study was to investigate possible predictors of the sustainable behaviour of using a reusable hot drink cup. Using hierarchical multiple regression it was found that age, intention to reuse a cup, and environmental values were predictive of using a reusable cup. There was also a relationship between intolerance of uncertainty and cup use, but only where habit was strong.

Our findings partially support previous research, where intention was one of the strongest predictors of various environmental behaviours (Bamberg & Möser, 2007; Gardner & Abraham, 2008; Hines et al., 1987; Hoffmann et al., 2017). As pro-

environmental behaviours usually require additional actions, or non-monetary sacrifice, such as remembering to bring a reusable cup with you (Tseng, 2016), but do not provide a tangible reward, an intentional effort to engage in those behaviours needs to be made. There was also a significant bivariate relationship between intention to use a reusable cup and habit strength, indicating a strong correlation between the scores on the two scales. In other words, when intention is present, habit to use a cup is also strong, suggesting that both the intentional and habitual processes power the behaviour of using a reusable cup. This has also been found in other behaviours such as physical activity where the rewards may be more distal than the costs (Allom et al., 2016). As intention is usually a predecessor of formation of habitual behaviour (Lally & Gardner, 2013), it may be possible that with the absence of the tangible reward for this particular behaviour, intention is supporting the implementation of habitual behaviour through providing additional motivation.

We examined whether trait-like characteristics, such as intolerance of uncertainty, need for structure, conscientiousness, and environmental values were predictive of using a reusable hot drink cup. The only significant direct relationship was between environmental values and behaviour. This is supportive of previous findings, where aspects of environmental values, such as norms, identity, and value orientations are associated with pro-environmental behaviours (De Groot & Steg, 2008; Nigbur et al., 2010; Verplanken & Roy, 2016). It is also reflective of the motivational aspect behind engagement in pro-environmental behaviours: environmental self-identity and intrinsic motivation (which is based on values) play an important role in engagement in pro-environmental behaviours in general (van der Werff et al., 2013a). The practical significance of this is the potential ability to enhance an environmental behaviour of using a reusable hot drink cup through emphasising the value of it to contribute to pollution reduction. It possibly can assist in promotion of other environmentally-friendly behaviours, however, that would require further investigation with the target behaviours. Consistent with previous work, there were strong correlations between conscientiousness, need for structure, and intolerance of uncertainty in our sample (Berenbaum et al., 2008). However, in our study conscientiousness and need for structure did not add to the explanation of variance in multivariate analysis. One possible explanation might be that when these variables are entered simultaneously into the regression model, the unique effects

likely did not emerge due to a large amount of shared variance. Another possibility is that intolerance of uncertainty might only be relevant to specific environmental behaviours, as taking care of the environment may reduce the worry for the future of the planet, however, this should be explored further.

We explored a moderation effect of habit strength on the relationship between intention and the use of a reusable cup, however, it was not detected. Previous studies have demonstrated, that in a range of behaviours, especially those that consist of several steps and are of distal benefit, habit usually has an association with behaviour, commonly with higher levels of habit strength taking over intention in predictive capacity (Mullan & Novoradovskaya, 2018). Initially there was a significant positive correlation between intention, habit strength, and behaviour, however, after putting the variables into the regression model, only intention emerged as a significant predictor of behaviour. One of the possible explanations, for the nature of a relationship between habit strength, intention, and behaviour in this study, is that the behaviour of using a reusable hot drink cup is relatively novel and thus has not reached the levels of automaticity that reflects the presence of habit. This is reflected in the self-report habit index scale results: in our sample, scores on habit were around the mid-point of the scale (*M*=3.72, *SD*=1.56), which indicates a moderate level of habit strength rather than a high one. It might be attributed to the contextual factors as well: for example, KeepCup™, the largest producer of reusable cups in Australia, has been around only since 2007 (*The Story of KeepCup*, n.d.), with the reusable cup becoming more widespread only in the past few years.

Finally, the relationship between intolerance of uncertainty and behaviour was only evident for those who reported strong habits of using a reusable cup. This relationship sheds some light onto the role personality dispositions may play in the formation of habitual behaviours: adoption of regular routines might be a coping mechanism for dealing with negative feelings towards uncertainty, as they provide more organisation and predictability to one's everyday life. The alleviation of uncertainty might thus be obtained through translating a strong habit into behaviour. It can be useful in tailoring habit-based interventions for certain target populations: individuals with higher levels of intolerance of uncertainty might benefit more from habit-based behaviour change interventions compared to those with lower levels of intolerance of uncertainty.

Strengths and Limitations

It is important to understand what drives relatively simple sustainable behaviours in everyday life in order to develop appropriate, evidence-based interventions to establish those. The current study's strength lies in an exploration of predictors of a simple, but novel, pro-environmental behaviour, which has not been studied in this manner before, as well as employing a prospective design that allows for prediction. It also has a practical significance in terms of the growing consumption of coffee and other beverages 'on the go' and the need for a sustainable solution to the creation of a large amount of landfill waste, associated with this behaviour (Poortinga et al., 2019). This study included a range of predictors, which had potential to assist in closing the 'intention-behaviour gap', some of which have not been explored in such a context before.

A possible limitation is the use of the adapted timeline follow-back measure (Sobell & Sobell, 1992). This might be a limited measure, as it relies on retrospective report of a very specific behaviour. It is also well-known that self-report might be biased, especially if behaviour is socially desirable (Van de Mortel, 2008). There has been a trend to move to more objectively measured behaviours, and some creative and inspiring attempts have been made in the area of environmental behaviours. For example, in the BinCam project, cameras were installed on the inside lids of household garbage bins and the footage shown to the participants to provide feedback on their recycling and household waste behaviours (Comber & Thieme, 2013). Another interesting assessment was performed by Holland et al. (2006) who placed paper recycling bins at office desks, and then counted the actual pieces of paper in the bin. These methods allow for more direct observation, however, they may be very costly and time-consuming. As a compromise between using objective and self-report methods in measuring pro-environmental behaviours, methods used for Ecological Momentary Assessment studies could be utilised to assess behaviour via self-report, minimising recall bias and increasing ecological validity (Shiffman et al., 2008). These methods have been used in clinical psychology (Trull & Ebner-Priemer, 2009), behavioural medicine (Stone & Shiffman, 1994), and organizational research (Beal & Weiss, 2003) among others. It is an interesting path for future research to try and apply this measure for more precise, less biased and inexpensive method to assess environmental behaviours.

Participants in our study may have been affected by the measurements taken at time one (Morwitz & Fitzsimons, 2004). We asked questions about their use of reusable cups as well as attitudes and values towards the environment, which might have affected participants' behaviour in the following week (e.g., try to use a reusable cup more, buy one or have more hot drinks while sitting down in a café). This in turn may have affected rates of behaviour reported at follow-up.

Our sample consisted predominantly of university students, with more than half aged below 21 (51%). Other studies (Gilg et al., 2005), along with data from our sample, suggest, that pro-environmental behaviours, including use of reusable hot drink cup, tend to be performed more with the increase in age. This is an important aspect when considering target audiences for interventions aimed at increasing pro-environmental behaviours: as the behaviours tend to manifest with age, it might be of importance to tailor the interventions towards younger audiences, who are less likely to adopt the behaviours via non-tailored behaviour change pathways.

Conclusions

The current study adds to the body of knowledge regarding predictors of using a reusable hot drink cup. Environmental values and intention were found to be important for regular performance of the target behaviour. There was an indication that individuals who have high intolerance of uncertainty report more use of a reusable cup when habits are strong, which may be important for tailoring interventions for specific target audiences. However, this needs to be investigated further. Intention and environmental values could be used in the development of future interventions to increase use of reusable hot drink cups. These results are promising as they may contribute to the adoption of sustainable behaviours and ultimately improve the state of the environment.

Chapter 3. Comparing Expert and Lay Views on Habit

The first study of phase one (Chapter 2) demonstrated the importance of environmental values and intention in predicting the behaviour of using a reusable cup. As the researcher was interested in how habit can be helpful in changing pro-environmental behaviours, study two is dedicated to investigation of the concept. In this study the concept of habit and its usefulness for behaviour change interventions was explored through the lens of both potential intervention recipients and intervention developers. In the current chapter, using qualitative methodology, how lay people understand what habit is and whether it is similar to the opinions of researchers in the field was investigated. This study helped in informing one of the treatment conditions within the behaviour change intervention (study three), identifying what is important to target, and how best to deliver a habit-based intervention to participants. The results of this study also have implications for the development of definitions and interventions in the area of habit psychology.

Author	Contribution	I acknowledge that these represent my contribution to the above research output. Signed:
Elizaveta Novoradovskaya	Conceptualisation, Methodology, Data Analysis, Investigation, Data Curation, Writing, Project administration	
Barbara Mullan	Assisted in Conceptualization, Methodology, Writing - Review & Editing, Supervision.	
Penelope Hasking	Assisted in Conceptualization, Methodology, Writing - Review & Editing, Supervision	

Abstract

Consumers are often not included in consideration of our understanding of scientific concepts within psychology. Habit, as something we do automatically, is one of those concepts. Including lay people in the conversation around what habit is may be helpful in developing successful behaviour change interventions. The aim of this study was to compare how lay people and experts in the field view habit, and what lay definitions of habit may mean for understanding of the concept within psychology. Lay people ($n = 23$) and researchers in the area of habit ($n = 11$) participated in semi-structured interviews around the concept of habit. Similarities around fundamental aspects of habit are discussed, and attention is focused on differences in the views of lay people and experts regarding components of habit. This research has identified areas where habit psychology can be advanced, as well as where improvements in science communication can be enacted.

In recent years habit has become a 'hot' topic in popular psychology, with several well-selling books appealing to the power of habit to change one's life for the better (e.g. Dean, 2013; Duhigg, 2013). Moreover, '21-day challenges' have gained popularity: it is claimed that within 21 days one can acquire a new, life-changing habit, be it meditation, diet, exercise regime, or a work routine (Chua, n.d.; "Purposeful Habit Design," n.d.). In these books and online resources habit is regarded as any everyday behaviour without much consideration of its characteristics or complexity, which may create heightened expectations among readers. Research has demonstrated that there is no 'magic number' when it comes to how long it takes to form a habit: it takes anywhere between 18 to 254 days (with a mean of 66) to form a habit, dependent on the particular behaviour (Lally et al., 2010). These and possible other beliefs about what a habit is, how it is formed and what might facilitate habit formation, are an interesting topic for further exploration.

Scientific Views on Habit

The problem of definition is not new to scientific inquiry. In order to communicate effectively with others in the field, as well as with those who are on the 'receiving' end of the academic effort, i.e. community members, clients, patients, or consumers, consensus is needed on terminology. The question of defining the main terms in a specific area of research usually arises when different researchers use different terms for the same concept (Gardner, 2015). This can be seen in the area of habit psychology, which is represented by a number of scientists with backgrounds in health, social, experimental, and clinical psychology, among others (see Verplanken, 2018). As quite a small area (e.g. Verplanken, 2018; Wood & Rünger, 2016) the psychology of habit is a field of continuous discussion about what 'habit' as a concept encompasses, which behaviour it can be applied to and by which mechanisms (for example, see Gardner et al., 2019; Mazar & Wood, 2018; Phillips, 2020), and, consequentially, a problem of measurement of the construct according to existing definitions (Gardner et al., 2012).

There have been several reviews of the definition of habit, which are helpful in understanding broader definitions within specific fields (Fleetwood, 2019; Gardner, 2015; Verplanken, 2018; Wood & Rünger, 2016). Those reviews indicate that the definition of habit has common features across different lines of research, such as automaticity, importance of cues that trigger habit, stable context and rewards,

rigidity of habit, and formation of habit via repetition. Some of the areas that have produced active discussions around the concept of habit include, for example, the conversation around habit being an impulse that may or may not result in habitual behaviour, rather than a behaviour in itself (Gardner, 2015). Not only had this discussion allowed for more space for behaviour change, it also disentangled confusion between habit as a determinant and an outcome of behaviour. Another discussion stems around the complexity of habitual behaviour, with suggestion of distinguishing habit initiation and habit execution (Gardner et al., 2019; Hagger, 2019; Phillips, 2020), and, on the other hand, defining complexity in terms of the number of steps in the behaviour and the proximity of reward (Mullan & Novoradovskaya, 2018). These conversations continue, introducing more and more detail around the definition of habit.

Lay Representations around Habit

Habit scholars emphasize the practical applicability of habit research, as knowing more about what habits encompass and how they work, can assist in forming evidence-based effective interventions for organisations and individuals (Liddelow et al., 2020; Mergelsberg et al., 2020). In the areas such as general and mental health, consumers are often included in the research process, and in developing appropriate intervention and service delivery (Kidd et al., 2007; Popay & Williams, 1996; Walsh et al., 2016). An inquiry into the perspectives of lay people, who are the prospective recipients of habit-based interventions, might provide some applied insights as well as grounds for comparison with the experts in the field.

The emphasis on including lay views along with expert opinions on a range of problems has been outlined in other areas, for example, in public health (Popay & Williams, 1996). Psychology directly studies behaviour, thus humans, as recipients of the findings, should be taken into consideration as 'lay experts'. Target community members are capable of providing insightful views on psychological processes and ways to improve behaviour change interventions, among others. In an age when trust in scientific knowledge and findings is being constantly undermined (McClean & Shaw, 2005), including 'lay experts' in the process of scientific research can strengthen the connection between scholars and the community. Establishing a conversation and consensus between experts in psychological science and lay people may be a way to gain more trust and applicability in psychology, where science is not

an 'ivory tower' but something that can be constructed by experts and consumers together.

Recently an investigation into lay representations around the definition of habit has been carried out by Brown et al. (2019) and is available as a preprint. The results were indicative of broad similarities between the way community members define habit and the scientific literature. Participants were students of a large University in Australia and the study involved a survey of open-ended questions about what habit is ($n = 158$) and a series of interviews and a focus group ($n = 27$). Participants identified habit as a behaviour as well as an impulse to engage in a behaviour; they identified key features of habit being automaticity, repetitiveness, frequency, being performed in a stable context and tendency to be comforting; habits were also generally viewed in terms of being positive (goal-dependent) or negative (goal-independent). Habits were also defined as simple behaviours, or clusters of behaviours (routine) or as features of self-identity. These findings reflect some similarities between scientific understandings of habit within psychology, but also indicate a lack of common conceptualisation of, for example, whether habit is an impulse or a behaviour, or how complex the behaviour can be and still be habitual.

In the current investigation it was aimed to expand on this research by providing insight into overlaps and differences between the views of experts in the field and the lay community, which can help in understanding the possible discrepancies and applying the results to practice for developing successful interventions that reflect both scientific findings as well as views of the very population that is to benefit from said interventions. This conversation can outline future areas for development of habit psychology as an applied field, should differences in interpretation arise. It may also facilitate conversation with the consumer, where researchers have more awareness of where to focus further science communication efforts to create a mutually beneficial understanding and better intervention outcomes.

Therefore the aim of this study is to compare the views of experts in the field of habit psychology with lay community members on what habit is. Specifically, the question asked is: are there differences in the way experts and lay people conceptualise habit? An additional research question asked of the experts was: is it important for researchers to know what the lay representations around habit are?

Methods

Participants

Representatives of the lay community were recruited from a large Australian university, through a website where students can participate in research in exchange for study points. Undergraduate students (n = 23) were almost equal in gender distribution (47.8% female; no participants identified as non-binary), and age ranged between 18-29 years (M = 21.61 years old; SD = 2.89).

Interviews were also conducted with 11 experts in habit psychology. A researcher was considered an 'expert' if they had minimum five years of experience doing research in a relevant field (publications or research in the area of habit psychology, including doctoral degree publications), thus including both early career researchers and more senior academics. We also attempted to reduce the potential of conflict of interest arising: several researchers were not contacted as they have direct involvement with this paper's authors. Overall 21 experts were contacted via email, 15 replied, and 11 interviews were conducted. Early career researchers (within five years of finishing their doctoral degree) comprised 36% of the sample, with senior academics representing 66%. Researchers were from Australia, Canada, the UK, the Netherlands, and the USA.

Design and Procedure

Semi-structured interview schedules were developed by the first author and reviewed by co-authors. They included open-ended questions to elicit broad responses around the construct of habit. The authors were careful not to impose any of their own worldviews onto the questions to avoid leading participants to provide certain responses. Both groups were asked questions around their understanding of habit, with prompts around examples (for lay people) and scientific literature (experts) given if deemed necessary by the interviewer. Experts were also asked to reflect on usefulness of understanding 'habit' in the same way as lay audience does. Both interview schedules for lay people and experts were pilot-tested before data collection and appropriate changes were made (for interview schedules see Appendix 3). The different sample sizes for lay people and experts were based on the information power (Braun & Clarke, 2019b), where the rich data received from experts can involve fewer participants, whereas individual interviews with students were less rich in data, thus requiring more participants to have a better understanding

of their perspectives. Data collection among the experts was also limited by availability of the respondents.

Interviews were conducted by the first author and audio-recorded and transcribed verbatim; a consent form was signed prior to the beginning of the interview. Interview questions were carefully formulated not to reflect any particular position or stance. Interviews with lay people were conducted on the main university campus and took between 20 and 30 minutes. Interviews with experts were conducted over Skype™ or Zoom™ at a mutually agreed time and took around 40-60 minutes. All data were collected during 2018. Ethical approval was obtained from the University Human Research Ethics Committee prior to data collection (see Appendix 1).

Analytical Strategy

Data were analysed using reflexive thematic analysis (Braun & Clarke, 2006, 2019a) with the aid of specialised software NVivo 12. Following the specific steps outlined by Braun and Clarke (2006), initial data coding was conducted by the first author, producing a large set of semantic and latent codes. Then secondary coding was performed to apply patterns to the initial codes and outline preliminary themes. Several main themes were created based on the codes, with subthemes outlined within them. It is important to acknowledge the previous experience that the research team has within the area of habit psychology, and thus the formulation of themes was likely influenced by the previous knowledge, and the analysis was theoretical rather than inductive (Boyatzis, 1998). Lay people's and experts' transcripts were analysed separately and were merged at the interpretation stage.

Results

Lay People

In interviews with lay people two major themes were identified: the main features of habit, and forming and breaking habits. The graphic representation of themes can be found in Figure 3.1, with examples of codes reflected in Table 3.1 (Appendix 4).

Figure 3.1 Main themes imposed on interview data with lay people and experts within habit psychology
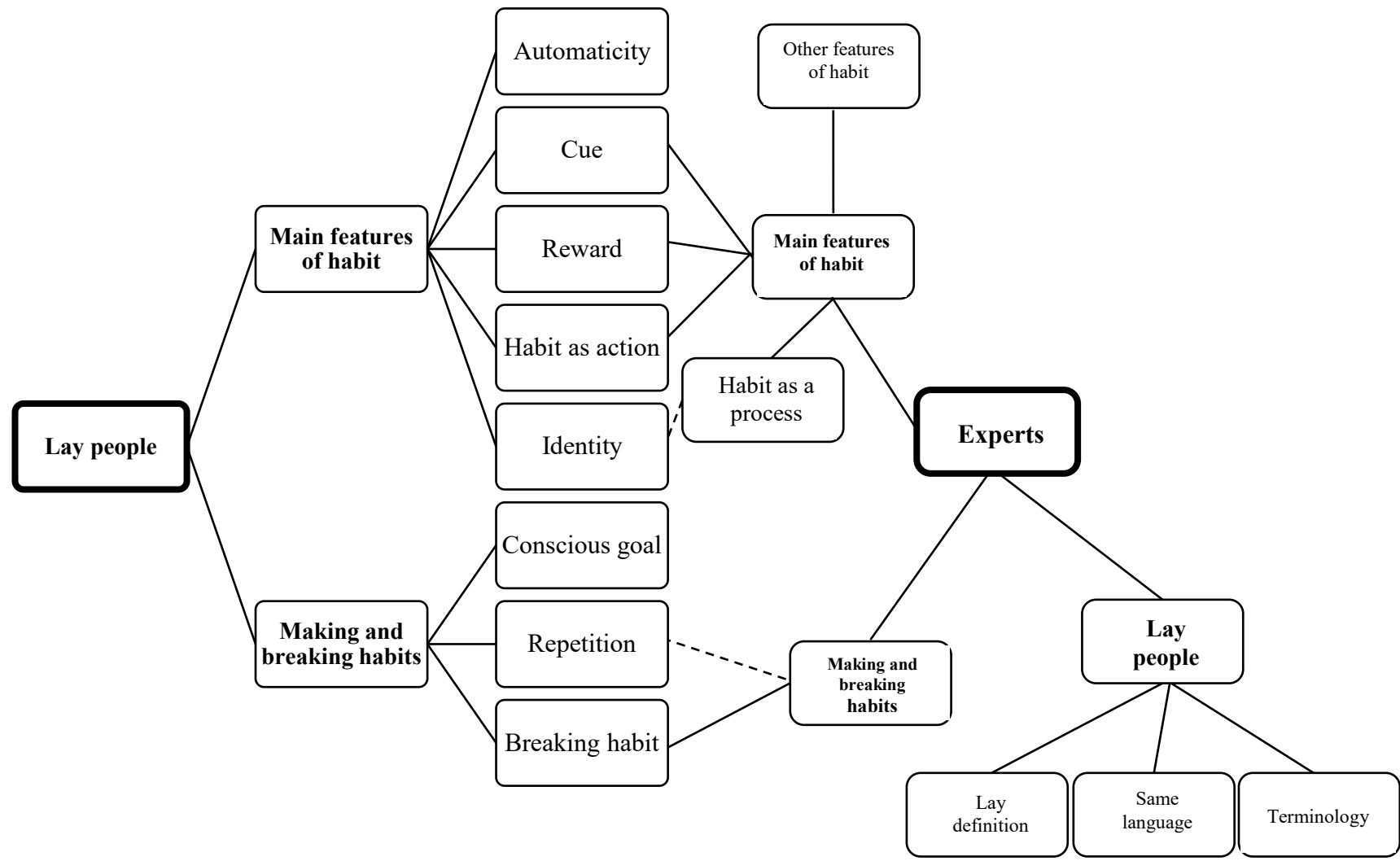
Main features of habit. This broad theme mainly appeared when participants attempted to define what habit is in their own words. A wide variety of characteristics of habit were named, among which habit was labelled as addiction, a chore, flow, a reflex, a craving, a fidget, or conditioning. However, in general participants seemed to identify several main characteristics of habit.

Automaticity. The majority of participants named automaticity as a predominant feature of habit. It was referred to as "something that you unconsciously do", "I do without realising", "a passive thing", or "something that… I do out of instinct". One participant said: "I feel like it's so automatic that it just happens naturally".

Cue. Participants expressed various views on what triggers habit, and the component 'cue' came up often. Some participants expressed that they have an external cue, such as an alarm to remind them to do things, or having the cue in a visible spot. One participant reported on their use of sunscreen:

> *… But it started when I keep it [bottle of sunscreen] out, it reminds me to do it. So before I leave I quickly put some on. Otherwise, if it was in a drawer or something, I wouldn't do it. It has to be on a shelf otherwise you know, I wouldn't do it.*

Some lay people talked about cues as habit "chunking" (Wood & Rünger, 2016), where one habit follows another, becoming a cue for it. Participants had habit chunking connected to various behaviours, starting from morning routines such as taking a shower or having a coffee, taking vitamin supplements, to cleaning their room or vaping. One participants said about their morning hygiene routine:

> *Habit is just being clean; I like my personal hygiene. So in the morning I always have a step by step process of going to have a shower, wash my face, exfoliate and moisturise and then brush my teeth...*

A number of participants reported on having social cues that trigger certain behaviours. Those who were involved in team sports reported that staying fit and training was heavily reliant on being around their teammates, as in the off-season the habit of exercising did not persist. Other habits that were reported to rely on social cues were drinking alcohol, vaping, bringing a reusable cup to campus, drinking tea, and eating healthy. One participant reported on their habit:

Because my social life is….at that peak in my life really. So most weekends, yes, I do drink because there's… some of my friends always invite me over.

Some participants named some internal cues, such as their emotions or moods, which mainly triggered negative habits. Habits such as overeating, checking social media, or not having breakfast were named, that were provoked by anxiety, stress, boredom or previous negative experiences. One participant said about their negative habit of biting their nails: "I used to sit there, you know, maybe like nervous times or anxious times, sit there nibbling away on my nails". Another person, however, reported how anxiety over their acne helped them get into a positive habit of taking care of their skin.

Reward. Participants mentioned rewards as important to keep doing behaviours that become habitual. Participants talked mainly about internal rewards, such as feeling better about oneself, feeling good or having routines feeling 'comforting'. One participant reflected:

I like being comfortable and like having the same thing kind of go on. So for me my habits are almost comforting to be like "Yes I've got to do that every day".

Among external rewards, grades were mentioned as a reward for having a good study habit. Otherwise, seeing the results that come from, for example, taking care of one's skin, eating healthy or exercising regularly were mentioned as rewards or motivators to keep repeating a behaviour until it becomes habitual.

Habit as action. Unanimously, participants in this study referred to habit as something that they do. One participant referred to it:

Something that a person always does every single day no matter what. They're just so used to it they do it a lot.

Habit as part of identity. Participants referred to having habits in their lives as something inherent to their personality, or how they identify themselves. This applies to both, having and not having many habits. Some participants said they are "not very habitual", or do not have habits because they are forgetful or lazy. Others said that sometimes their values underlie their behaviour, for example, picking up rubbish becomes a habit when one values protecting the environment. One participant said:

I'm the kind of person that likes ...doesn't like change... I like being comfortable and like having the same thing go on.

Making and breaking habits. The second theme related to forming and breaking habits.

Habit starts from a conscious goal. Participants reflected that if one wanted to form a habit one would have to start from a conscious goal, a desire to change, which then through the process of repetition would become a habit. One participant reflected on their habit of going for evening walks:

I just set myself a little goal of wanting to go [for a walk] twice a week so I'd go twice a week and then it built up till, eventually, I was going for about an hour every evening.

In this process participants also reflected on how it is difficult to start a positive habit, but it gets easier with repetition. Some said that it is easier to form habits but hard to break them. Participants also outlined some of the factors that in their experiences helped them in the process of habit formation, including: motivation to change, external pressure (parents, managers or friends 'force' them to do something), guilt, having free time to start a habit, life transitions (moving away from parents' home, having a baby).

Repetition. The majority of participants referred to repeating behaviour until it becomes a habit as an important factor. As many participants referred to habitual behaviours being something they do every day, regularly, repeating the behaviour over and over was deemed quite important. One participant reflected:

…When I just think of habits, I think of something that I do repeatedly. I don't have to be, "I'm going to take a shower this morning" type of thing. I wake up, and then I just hop in the shower. I see it as kind of passive thing. Initially it's active then it becomes passive.

Breaking a habit. Participants also talked about breaking habits, or more so about stopping the unwanted, 'bad' habits. Among some of the habits participants wanted to break were drinking alcohol, eating unhealthy, biting nails and cracking joints. However, the predominant negative habit, that they would like to get rid of, was using one's phone all the time (mainly social media). Some participants reported that they do not know how to get rid of this and other bad habits, whereas a few others had ideas on how to reduce their phone use:

Deleting social media. I've deleted Facebook off my phone but now it's just the other stuff that I think I need to get rid of it. I think that will help.

One participant suggested that in order to get rid of a bad habit, a good one needs to be introduced instead:

I guess probably just finding a meaningful alternative to them. You know I love ice cream as most people do. I guess if I found something that was healthier for you but I felt tasted the same…

Participants also talked about lapses in habit, when there is a stretch of time when the habitual actions are not performed, for example, going on holidays, stress, or having exams. They mentioned that it is difficult to go back into a habit again after taking time off. One participant said the following:

It was difficult to… I suppose especially when you have the little breaks like your holidays. And then to come back to semester, to get back into it was quite difficult, to be like, okay, you actually need to go and do this. And then it became a bit more like, okay, cool, I'm just getting up and I'm going to go do my uni work. Whereas at the start of semester I'd be like, oh, I'm not used to this.

Experts

Two main themes that were outlined within lay population were also identified in the expert data, plus an additional theme of lay and experts speaking the same language. Themes with examples of codes can be found in Table 3.2 (Appendix 4).

Main features of habit. The main features of habit that came up in the conversations with experts bore many similarities to what lay people referred to. Experts similarly named automaticity, cues and reward as the main components of habit. However, a much broader concept of what habit is, with a few points that are different between experts and lay people were also identified.

Automaticity. Experts mentioned a degree of automaticity that makes habit different from other subconscious behaviours, such as priming, for example, and different from deliberative, intentional processes. It was also one of the central pillars to the definition of habit. One interviewee mentioned:

I have a broader view of habit, which would be certainly an automatic behaviour. I think automaticity of action is key to what makes habit a habit, so that's something I will keep as a kernel of habit.

However, with automaticity being one of the main characteristics of habit, there is still room for decision making or deliberative processes. When talking about health behaviours, for example, hardly any of them were non-conscious, according to one of the interviewees. One researcher reflected:

I think for me one of the mechanisms that is likely to contribute to habitual behaviour or habit is a stimulus-response learning mechanism. And I don't think stimulus-response association will be that forceful that you couldn't make a different decision, no you definitely still can choose.

Cue. Cues were identified by experts as another central pillar of habit. A lot of emphasis was made on cues not being only external physical objects in the environment, but internal or social, which also came about in lay people's interviews. One expert said:

And [habit] it's triggered by specific cues in the environment because it's …habits develop in or under stable conditions in the presence of specific cues. And then these cues become related to behaviour and automatically trigger this behaviour. But these cues in my opinion could be anything. We have written and seen a lot of focus on environmental situational cues but it might also be an internal cue, like feeling bored, for example.

As an important aspect, related to the cue, experts outlined *stable context* as a crucial component of habit definition. As one of the interviewees reflected: "…habits develop in or under stable conditions in the presence of specific cues".

Reward. Reward came up as another pillar that was mentioned by experts. The problem of behaviours being naturally rewarding (e.g., consuming sugary food) versus not naturally rewarding (e.g., taking medication) was outlined in terms of effective habit formation, as well as rewards being especially important in the beginning of the process of habit formation. One of the researchers gave an example:

I haven't been to the gym for years but if I went to the gym now and tried to lift weights, you know, I could do it in that I'd give it a go but I won't be very good at it. So then, I might come out of it thinking I don't really want to do that again, I don't feel very good about myself, that wasn't a good experience.

So it's going to be less reinforcing than if the behaviour was something that you know I wanted to do, I found pleasurable when I'd done it.

Habit as a process. One of the features that has not been clearly expressed by lay people, was defining habit as a process rather than action. Experts almost unanimously highlighted the prevalent view in the field, that habit is not defined as behaviour or action, but rather an implicit construct. One researcher said:

Let's call it a disposition that exists in someone's brain, and then you've got the outward performance of that, so it is the habit, the thing that's in the person's head that guides their behaviour or is it the outward performance.

Another one summarised it in terms of a broader research perspective:

But I don't think as a field we can have theories where we say habit predicts behaviour and then define habit as a form of behaviour which has been done in the past. <...> I think we also need to define it in a way that's different from the behaviour we're trying to predict.

Other characteristics of habit. Some other relevant aspects of habit were named by experts, such as rigidity of habit. One researcher reflected:

Habits are fairly resilient and not tied to very strict external contexts or they wouldn't be adaptable and people, they would move location and then they would be lost, they would be useless human beings until they started from scratch.

Another aspect of habit that was reflected on by the experts was that habit is one of the predictors of behaviour, which is consistent with the definition of habit as an implicit construct rather than behaviour itself. One of the experts said: "… the other thing I'd add to all of this is I see habit as only one input into any one behaviour".

Making and Breaking habits.

Habit formation. The process of habit formation was referred to frequently, and it was often associated with the process of learning:

...for me habits are really learnt sequences of actions that are automatic responses towards the specific cue in a stable environment and that's very broad. And (it's important there) become insensitive to changes in the outcome. ...So what is important there is first of all is that it's learnt.

This perspective was reflected upon by several experts. However, one of the interviewees mentioned: "I don't think the repetition is enough of a condition for

habit formation". They based their answer on the evidence from replication studies: "… we do not have an experimental paradigm that properly shows habits as a function of repetition".

Experts also shared some of the things that may be helpful in the process of habit formation, such as focusing on simple habits, rather than complex ones. One researcher reflected:

I think that the original kind of habit notion was with much simpler behaviours. And it probably was a lot easier to understand this kind of stimulus provokes a stimulus behaviour response and it's almost associated with the behaviour itself.

On several occasions experts brought up implementation intentions (if-then statements) (Gollwitzer, 1999) as an effective tool for habit formation:

And making even complex things as simple as possible, I guess breaking them down to make them as simple as possible… I always think about, I am a big fan of implementation intentions. <…> I think they're really good for forming new habits. Because at the beginning people are anticipating obstacles and helping themselves, set themselves up, making things simple essentially, so that step by step is very simple to them…

Breaking habits. Experts talked about breaking habits, disrupting them, and habit inhibition. One of the researchers reflected:

[I am] seeing habit not as something that directly cues behaviour but as something that cues an impulse to do behaviour. And the reason I think that's important is that if we say that habit directly cues behaviour then that means that by definition we've got no hope if we want to change a habitual response because it automatically happens, it will directly happen and there's nothing we can do. But… the point about impulses is that the habit triggers an impulse and the impulse might not translate into behaviour, if there are stronger counter impulses, if we don't want to do it. And we know we've got research showing that people can inhibit their habitual actions.

Other researchers expressed an opinion that breaking a habit, making it stop from occurring, is very difficult, and habit should be attempted to be substituted with another one rather than simply removed. One of the experts said:

I actually have a really strong opinion on that, it's almost impossible to stop doing something, humans are terrible at non-occurrences, recognising non-occurrences. I think just in general you have to have substitution. If you want to stop doing something, you have to replace it with something else.

Lay people's view on habit. A large theme that was informed by the main research question of the study was about the experts' opinions on how lay people view habit and whether it is necessary for lay people and scientists to speak the same language when it comes to habit.

Lay definition of habit. Some of the researchers expressed the view, that how lay people think about habit differs from how scientists do. As one of the interviewees said: "People don't usually think in definitions". Another one reflected:

… everyday people don't have a great introspective grasp of what habit is especially I think a lot of people think that habits are kind of unconscious motivations or unconscious goals. <…> They're also not that good often at working out which specific behaviours of theirs are habits or not.

From that also stems the idea that lay people are generally confused about what habit is. One of the researchers reflected:

I think that lay people confuse two important things with habit and that would be frequency of behaviour or past behaviour, those [are meant] to be habit even though those are multi-determined and only part of that is habit. <…> And so they're just missing the complexity of the behavioural determinants.

Researchers use simpler definitions of habit along with examples, when communicating with lay audiences or intervention participants. One of the researchers shared:

So the way that in previous interventions that I've worked on the way that we try and communicate that idea is just like using lay terms like you know if you repeatedly do this you should form a habit. <…> So we don't need to bring in kind of hard core scientific jargon you just tell them that actually this is going to feel like brushing your teeth after a while you'll just do it, you won't think about it and it'll be easier for you.

Experts expressed varying opinions on whether or not it would be useful to speak the same language as the lay people do, especially when developing and

implementing interventions. Some researchers shared that it would be useful, and others said it would not be as helpful, if even possible.

Lay and experts should speak the same language. Some experts expressed that clarity in communication between intervention providers and intervention participants is needed for the effectiveness of said interventions. One of the researchers said:

If you really want them to understand your intervention then I think it would be certainly necessary to either explain that we are using a different meaning of habit than what is generally considered because I think it's pretty widely just the behaviour that in the lay public is the definition of habit.

Some of experts reflected on science communication along with the usefulness of educating lay people during interventions on what habit is.

I think it's always important to communicate our science and when you're administering an intervention to help people develop habits I think there's certainly a benefit to educating them on what that means and why it's important and what things won't work.

The need for speaking the same language has been expressed:

If we are communicating with the population and we are trying to translate our knowledge to practice, and we don't speak the same language then we might get a big misunderstanding.

Lays and experts do not need the same language. Some of the experts expressed the view that lay people and researchers would not speak the same language, that this is unnecessary or even impossible. One of the researchers said, reflecting on use of the same language in behaviour change interventions:

We perceived that they didn't really need to know what habit was for this manipulation, they more needed to understand how to make implementation intentions. And then the hypothesis that this might influence habit was sort of on our end of the experiment rather than them having to know that.

Another researcher expressed that it is important to speak the same language with the lay people in interventions, but not in communication among scientists:

Only when we are doing an intervention we have to speak the language, we don't have to do it, I think, in our more specialised publications. That is impossible, because <...> the idea of what the habit is is so different of the

lay audience, so that would not be a base for us to form our scientific definition.

The term 'habit'. Finally, a few experts brought up a problem that seems to contribute to lay people's and researchers' understanding and referring to habit in different ways: the term 'habit' itself. One researcher described it:

I mean I think that the word 'habit' is often used in lay definitions for a common or regular behaviour. But that behaviour could be under all kinds of different reasons, right? So it could be motivational, it could be self-regulated or it could be actually more in line what we were just defining habit as. So I think lay terminology can be part of the problem perhaps because habit is a word that gets used a lot for behaviours that people do regularly.

Discussion

Within the current study lay people outlined various definitions of habit, including comparing it to reflexes or addictions. However, a few characteristics of habit were commonly mentioned, such as automaticity, cue (trigger of habit), reward, habit as an action and habit as a part of their identity. Experts also defined habit in terms of it being an automatic response to a cue that is rewarded (at least in the beginning of habit formation process). These features are central to current definitions of habit (Gardner, 2015; Wood & Rünger, 2016). Experts, however, provided more detail in terms of the main components of habit. Automaticity was named to be crucial in the definition of habit, however, there was still a belief that there could be some decision making in the process. Complexity of cues was also underlined by experts and lay people alike, including not only physical cues (e.g., seeing a bottle of sunscreen and using it), but internal cues (feeling bored or stressed) or social cues (doing activities with friends). Experts also explicitly added that cues are a salient feature of the stable context, where the behaviour is performed, emphasising the importance of the said context in the process of performing a habit. As habit is a result of a learning process, a stable context is important for establishing habits (Ouellette & Wood, 1998). Reward is also an important component in the process of learning, establishing a habit, which was outlined by both lay people and experts, who believe that the reward is important at the initial stages of habit formation, but loses the importance later on (Judah et al., 2018).

One of the key differences that arose between how lay people and experts define habit is whether it is behaviour itself or an impulse to perform the behaviour. Experts generally believe habits are impulses that may or may not lead to action, and the repeated behaviour itself is referred to as habitual behaviour (Gardner, 2015). However, among lay people habit is still defined as an action. This may be due to difficulty of reflecting upon implicit, automatic processes (Hagger et al., 2015; Sniehotta & Presseau, 2011), and absence of a need to distinguish between the two. Acknowledging these differences in understanding of habit may assist in the way scientists communicate with lay audiences within behaviour change interventions, emphasising the fact that habit is not the same as behaviour. Viewing habit as an automatic behaviour can be problematic, as it may prevent effective behaviour change: if habit is similar to reflex, it is extremely hard, if not impossible, to change.

Another difference that was evident between the lay people and experts is the role identity or personality plays in the definition of habit. Lay people consistently mentioned 'being habitual' when talking about habit, whereas within the expert interviews there was no explicit mention of this. As lay people were talking about concepts such as liking routines, not liking change, being organised/ not organised or lazy as to why they do or do not have habits in their lives, one explanation may be that they are actually talking about self-regulatory skills, like self-control (Adriaanse et al., 2014; Allom et al., 2018; Liddelow et al., 2020), or personality traits like conscientiousness, which are connected with habit (Vishwanath, 2015; Wood, 2017), but are not a part of habit as such within the scientific community. This is also an important factor to communicate to intervention consumers, that being non-habitual, 'spontaneous' does not necessarily mean the absence of the possibility to develop healthy habits. Experts also mentioned rigidity as a feature of habit, which was reflected by lay people mainly in terms of difficulties in breaking habits. Where lay people may have a picture of habit as an automatic behavioural pattern, experts emphasise the complexity of behavioural determinants and habit being only one of them. This complexity can also be communicated to lay people, outlining how a behaviour does not have to be completely automatic, almost reflexive, but rather habit can be one of several determinants of behaviour.

Forming and breaking habits was another big theme that was outlined within the data. Habit formation has common points with the main features of habit theme,

with emphasis on the process, as well as how habits may break or change. One thing that lay people said was that motivation underlies formation of good habits. A conscious goal is needed initially to form a positive habit, such as going for a walk or exercising. Experts did not explicitly mention it in the interviews, however, it is widely outlined within the published literature, with, for instance, habit moderating the relationship between intention and behaviour (Danner et al., 2008; Liddelow et al., 2020; Menozzi et al., 2017; Verplanken et al., 1998). This also helps shed light on the fact that lay people often view various behaviours that happen regularly as habitual. Lay people referred to behaviours like healthy eating or exercising, with both intentional and automatic components, as habitual, oftentimes mentioning repetition as an important component, whereas there was an expert opinion expressed that habit is not simply a function of repetition or frequency. In literature, as well, behaviours that occur infrequently, such as blood donations, are discussed to have a habitual component to them (Ouellette & Wood, 1998; Verplanken, 2006). Lay people also mentioned feelings of guilt or external pressure as motivators to form certain habits, which are generally connected with negative long-term outcomes within behaviour change (Kuijer & Boyce, 2014). Change of context has also been mentioned by lay people as a facilitator of behaviour change, which is known in habit psychology as 'window of opportunity' for establishing new habits (Verplanken & Roy, 2016). These findings can assist in promoting healthier and more long-lasting behaviour change based on principals of habit when communicating with intervention recipients.

When discussing breaking habits, different terminology was used by lay people and experts. Lay people talked about 'getting rid' of the habit or stopping it, as well as about habit lapses, when the context changes (e.g., holidays, travelling). Experts, on the other hand talked about breaking habits, habit inhibition or disruption. When it came to some of the ways to break or 'get rid of' a habit, both lay people and experts mentioned substitution. Some lay people also talked about removing the cue to the behaviour as something that helps them stop doing the behaviour, as in case with using social media, where deleting the app from the phone is removing the cue to go and check it (the app icon along with all the notifications). Experts, in turn, mentioned implementation intentions on several occasions, which are known to be an effective way to change behaviour by forming the 'if-then' plans (Gollwitzer,

1999; Verplanken & Faes, 1999). However, this method would unlikely be familiar to wider lay audiences, who have not previously participated in behaviour change interventions or specifically looked for relevant methods.

Finally, experts expressed their views on whether or not lay people and researchers should speak the same language when it comes to habit. First, experts expressed an opinion that lay people think about habit rather differently than researchers do. As one of the experts said, "lay people don't think in definitions". Lay people seem to think of habit in a simpler way, as something we do without thinking, missing the nuances, such as differences between habit and habitual behaviour, frequency of behaviour and ways to form or break habits, which are considered important within scientific enquiry. This, not in any way being interpreted as a negative aspect, creates a need to communicate science to lay audiences or to intervention consumers, to account for the discrepancies (Barnfield et al., 2017; Bruine de Bruin & Bostrom, 2013; Bubela et al., 2009). It may be beneficial to emphasise habit not being the behaviour itself, complexity of behavioural determinants, and that certain techniques, such as changing cues or using implementation intentions, can be helpful in forming or breaking habits.

With regard to whether or not speaking the same language between lays and experts is needed, two different points of view were expressed. Some experts said that it is important for researchers to speak the same language as lay people in order to avoid misunderstandings. Some experts spoke about the need for researchers to educate lay audiences on what habit is in science, using the interaction as a science communication opportunity. Others expressed that there is no need for lay people and experts to speak the same language as long as it is clear what techniques are used for changing behaviour. For example, when attempting to form a habit based on implementation intentions, it may not be necessary to explain what researchers mean by habit, but rather how to form implementation intentions correctly to reach a desired change in behaviour. Another researcher expressed that common language is needed within the experts, rather than between experts and lay people, and that lay definitions should not be considered in scientific publications, as it would create more confusion and remove the much needed nuances. As science has been considered an "ivory tower" for decades, clearer communication with the lay people, who are interested in research findings, needs to be employed (Nisbet & Scheufele, 2009).

The suggestion that came from a number of experts with regard to eliminating problems around definition of habit within the expert community, as well as between experts and lay people, is to find new terminology to replace the term 'habit'. As the word 'habit' is widely used in everyday language, and is widely shaped by popular literature (Duhigg, 2013) and various habit-forming challenges on the Internet, the word 'habit' itself has an established connotation, which may influence the communication between professionals in different fields as well as the understanding between lay audiences and researchers.

Strengths and Limitations

The current study is unique as it provides a side-by-side overview of how lay people and experts in the field view the concept of habit. It allows for the insight into lay perceptions of habit, and similarities and discrepancies that may be useful for the development of effective interventions and science communication. A qualitative exploration around the idea of habit is also helpful to get a deeper insight into what the concept means to different people.

Some of the limitations include the sampling of the experts: as the research team has been previously collaborating with a number of scholars in the area of habit psychology, interviewing them would impose a conflict of interest. Future research may employ an independent interviewer to reduce the bias and include a larger variety of expert opinions. Our sample of lay representatives was limited to students, potential recipients of the behaviour change intervention, however, future research may benefit from including a wider sample of community members to explore whether their understanding of habit would differ. This can potentially be useful for applying towards broader science communication and interventions efforts.

Conclusions

The current study investigated views of lay people on what habit is and compared this to the views of experts in the field of habit. Experts and lay people identified common features in conceptualisation of habit, such as importance of cues, automaticity of behaviour and necessity of rewards, as well as several aspects that differ between them, such as distinguishing habit as an impulse and actual behaviour, frequency of behaviour, habit as a determinant of behaviour versus a personality trait, and complexity of cues. These differences are important to utilise when communicating the likelihood of habits to change and benefit from habit-based

interventions. It is also important to communicate with a lay audience how less frequent behaviours can become somewhat habitual. Moreover, it was identified by experts that science communication and education of lay people is important, however, there is not necessarily a need for a common definition. An important suggestion to change the terminology around habit in scientific inquiry was raised, which could provide some more clarity in distinguishing between habit in lay understanding and habit as a research variable. Overall, current research emphasises the importance of conversations between experts and lay audience in order to develop the advancements in the field and science communication.

Chapter 4. Intervention to Promote the Use of a Reusable Cup

In study one of this thesis (Chapter 2) factors such as values towards the environment and intention to use a reusable cup were found to be important in predicting the behaviour of using a reusable cup. In study two (Chapter 3) how the concept of habit can be helpful in behaviour change was investigated. Study three is the first study of phase two and builds upon the first phase of the research: here, a behaviour change intervention to increase the use of a reusable cup was developed and implemented based on the findings of phase one, with study one informing the target mechanisms of the first two intervention conditions, and study two assisting in developing content for condition three. The intervention consists of three treatment conditions: 1) evoking environmental values, 2) strengthening intention, and 3) developing a habit of using a reusable cup. A control group was used to be able to evaluate the intervention effectiveness throughout six-week follow-up.

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Abstract

Globally approximately 16 billion paper coffee cups are being thrown away every year. One solution to this problem is using a reusable hot drink cup. We developed a behaviour change intervention to increase the use of reusable hot drink cups on an Australian university campus and evaluated its effectiveness; we also investigated the psychological mechanisms through which change happens; moreover, we extended the investigation on the previously established relationship between habit strength and intolerance of uncertainty.

Participants ($N = 156$) from a large Australian university were randomly assigned to one of four intervention conditions: 1) an intervention aimed at evoking environmental values, 2) an intention-based intervention, 3) a habit-based intervention, and 4) a control group with no direct intervention to increase use of reusable cups. At baseline, participants in the three intervention groups received a new reusable hot drink cup, and completed a pre- and 6-week post-intervention questionnaire assessing habit strength, intention to use a reusable cup, biospheric values, personal involvement and personal norms towards the environment, ecological worldview, and intolerance of uncertainty. The behaviour of using a reusable cup was recorded by participants using a phone app immediately after delivery of the intervention and at six-week follow-up.

There was a significant increase in the use of reusable cups, in all intervention conditions immediately after the intervention and after the six-week follow-up, compared to the control condition. The key mechanisms for behaviour change were similar between the intervention conditions, with groups increasing habit strength, especially if they had difficulty tolerating uncertainty. These findings offer suggestions for establishing habits in pro-environmental behaviour change interventions, as well as for tailoring habit-based interventions for those who are intolerant of uncertainty.

Introduction

Overconsumption, and the resulting generation of excessive plastic waste, has become a growing concern over the past decade. Tonnes of industrial waste and everyday household objects are floating in the ocean, overfilling landfills and are even found inside human and animal bodies (Barboza et al., 2018; Perkins, 2015; Xanthos & Walker, 2017). As individuals, our daily behaviours influence the state of the natural environment, such as recycling or using single-use plastics (Bleys et al., 2018; Gardner & Stern, 2008; Klöckner, 2013; Koger & Winter, 2011; Vlek & Steg, 2007). The transition away from single-use plastics is slowly happening around the world, with many countries banning plastic bags in supermarkets, with potentially banning all single-use plastics in the next few years (European Parliament, 2019, March 27).

The use of paper cups for take-away beverages is one of the lesser-known problems of plastic pollution. It has been estimated that up to 16 billion paper cups are being discarded every year (Suskevice & Grönman, 2019). These usually end up in landfills, as they are typically not able to be recycled (Lenaghan, 2017). The majority of paper cups are covered with a thin layer of plastic on the inside of the cup, which makes them unsuitable for general stream recycling (Ziada, 2009). Reusable hot drink cups, made of durable plastic, glass, metal or other materials, are becoming more popular, with some outlet stores offering a discount on drinks purchased in a reusable container. However, research shows that providing discounts does not significantly increase the use of reusable cups (Poortinga et al., 2019; Poortinga & Whitaker, 2018; Tseng, 2016). There are very few interventions aimed at increasing the use of reusable cups, but those that exist have demonstrated promising results. Poortinga and Whitaker (2018) implemented a large-scale intervention across several sites (universities and business office buildings). They used various strategies to increase the coffee shops' customers' use of reusable coffee cups: replacing the discount for bringing your own cup with an excess charge for purchasing a paper cup; information posters; and selling reusable cups or giving them away free of charge to customers. All strategies demonstrated an increase in reusable cup use after 10 months, with charging for single-use cups producing the largest change (Poortinga & Whitaker, 2018). Previous interventions have focused on systemic rather than individual level drivers of behaviour change. Systemic change

may happen through policies and organisational change, which are notoriously slow (López-Bao & Margalida, 2018). Hence, it is important to investigate psychological mechanisms that could be targeted in interventions to produce lasting behaviour change at the individual level.

Changing pro-environmental behaviours within environmental psychology has generally been approached by providing information about the environmental problems and what actions could be taken; setting goals to change behaviours to more environmentally friendly ones; making a commitment (usually public) to a particular behaviour; prompting and providing feedback on the behaviour (Abrahamse & Matthies, 2012). Providing information on the consequences of a harmful behaviour (e.g., using a plastic bag) and particular actions that can help reduce its effects, can evoke deeper values within individuals, which in turn might create intrinsic motivation to engage in behaviour (Abrahamse & De Groot, 2013). However, provision of information about the behaviour without offering a course of action is unlikely to produce a desired effect (Schultz & Kaiser, 2012). A change in behaviour is more likely to occur when raising of awareness about the behaviour and its consequences is paired with offering a viable alternative (Steg & Vlek, 2009). Further, intention to engage in pro-environmental behaviour has consistently been found to be an important factor in creating engagement in pro-environmental behaviours (Bamberg & Möser, 2007). Although intention tends to predict some variance in behaviour, an 'intention-behaviour gap', where intention does not translate into behaviour, exists (Godin et al., 2005; Sheeran, 2002; Webb & Sheeran, 2006). One of the possible solutions to the intention-behaviour gap may lie in the concept of habit (Gardner et al., 2011), and the predictive capacity of habit towards pro-environmental behaviours has been demonstrated previously (Klöckner, 2013).

Behaviours that are performed regularly, like buying your morning coffee in a reusable cup, can become habitual. Habitual behaviours are performed automatically, without much thought. They are usually learned through repetition as a response to a cue (e.g., having a coffee break at work) in a stable context (e.g., the office) and are followed by a reward (taste of coffee or rising energy levels) (Gardner, 2015). Habit, as a mental representation of that learned response to a cue, can help us save limited cognitive energy that can be used for slower, more deliberative processes (e.g., performing work tasks) (Wood & Rünger, 2016). It is ultimately better for the

environment, and us, if we engage in pro-environmental behaviours habitually, without thinking about them too much.

Pro-environmental behaviours, however, may not be as rewarding as, for example, eating chocolate, when the taste comes as an immediate reward, which is important for habit formation: whether we have coffee from a paper or a reusable cup does not necessarily affect the taste or effect of coffee. Thus, pro-environmental behaviour may be harder to make habitual, with the reward being temporally distal (Mullan & Novoradovskaya, 2018): reduction in landfill may only be reached in the far future. Some external incentives are usually offered for certain sustainable actions, (e.g., discount on coffee in your own cup), but research shows that effectiveness of those are limited (Poortinga et al., 2019). Thus, intrinsic motivation to develop a habitual pro-environmental behaviour might be needed (Barr et al., 2011), which is activated through deeper, more stable personal dispositions, such as environmental self-identity and values (Van der Werff et al., 2013b). Environmental values are associated with pro-environmental behaviours, a proposition supported by previous investigations (Fraj & Martinez, 2006), as well as our own research (Novoradovskaya et al., 2020). Our previous findings indicate that values towards the environment, along with intention to use a reusable cup, are associated with the use of a reusable cup. The intention to perform pro-environmental behaviours can be fostered in interventions through activities allowing the setting of achievable goals, which has proven to be effective for pro-environmental behaviour change (Abrahamse & Matthies, 2012; Steg & Vlek, 2009). Another possible predictor of pro-environmental behaviour is personality. In a previous study, we found a link between intolerance of uncertainty, habit strength, and the behaviour of using a reusable cup, where those intolerant of uncertainty, who reported stronger habits, also tended to report higher use of a reusable cup (Novoradovskaya et al., 2020). Intolerance of uncertainty is a personality characteristic, where the idea of unpredictable negative events occurring is distressing, regardless of the possibility of the events actually taking place (Carleton et al., 2007). It is possible that those who have difficulties withstanding uncertainty prefer adding structure and routine to their life to cope with the feelings of uncertainty.

Provision of free reusable cups also proved to be effective, demonstrating up to a 43% increase in use (Poortinga & Whitaker, 2018), as has self-monitoring

(Michie et al., 2009). In this study, we combined the known effects of fostering environmental values, developing intentions to use a reusable cup, and strengthening habit, with provision of a cup and self-monitoring to develop three intervention groups designed to increase use of a reusable cup. We created an intervention with three different treatment conditions and a control group. We decided to see which one of the three intervention strategies would be more effective for promotion of using a reusable hot drink cup. As there is no "magic number" for how long it takes to form a habit (anywhere between 18 and 254 days depending on the behaviour; Lally et al., 2010), we decided to follow-up on a behaviour after six weeks not to increase participant burden unnecessarily. We hypothesised that intervention groups would demonstrate a higher use of a reusable cup compared to the control group, which received no intervention or reusable cup, immediately after the intervention delivery and at the maintenance stage (6-week follow-up). We also hypothesised that specific intervention groups would use their reusable cups more through the corresponding psychological mechanism: 1) the group in which we fostered environmental values would increase behaviour through the constructs of biospheric values and/or personal norms, personal involvement, and ecological worldview; 2) the group receiving an intention manipulation would increase behaviour through strengthening intention to use the cup, and 3) the group receiving a habit intervention would increase behaviour through habit strength. As a secondary hypothesis, we tested the previously observed relationship of intolerance of uncertainty moderating the relationship between habit strength and behaviour (Novoradovskaya et al., 2020); we expected the relationship between habit strength and behaviour to be stronger for people who had difficulty tolerating uncertainty.

Methods

Intervention Content

The intervention comprised of four groups of participants, three of whom received one of the intervention treatments (Environmental Values, Intention or Habit) and one served as a control group. Each treatment condition included a set of behaviour change techniques (BCTs) – theory and evidence based methods, used in behaviour change interventions, for changing psychological variables that determine behaviour, such as, for example, provision of information to increase awareness

(Michie et al., 2013). Currently there are 93 BCTs identified within 16 different domains.

   Group 1 – 'Environmental values'. To evoke values towards the environment, a short video was played to participants. It showed the little known truth about disposable coffee cups not being recycled, which comes as a surprise to many and encourages reflection on one's own behaviour. A short clip was taken from the TV show 'War on Waste' (BBC, 2016) and was about two minutes long (Poortinga et al., 2019). Two BCTs were used in this intervention group from two domains: salience of consequences from "Natural consequences", which emphasises that the consequence of using paper cups is increase in landfill, and credible source from "Comparison of outcomes", highlighting the fact that the video comes from a credible television network, thus increasing trust in the source. The video aimed to outline memorable consequences (content that comes as a surprise to many), while being a credible source (BBC TV show with experts talking about consequences of excessive waste). After the video, participants were given a new reusable coffee cup, offered to them as an alternative to paper cups, and advised to use it for the next six weeks.

   Group 2 – 'Intention'. Participants were given a reusable coffee cup and the benefits of having one were explained (i.e., it is eco-friendly, gets a discount for coffee, is easy to use). We used a combination of action planning and commitment BCTs from "Goals & planning" domain, which have proved effective for enhancing motivation. The action planning BCT prompts participants to make a Specific, Measurable, Attainable, Realistic, Timely (S.M.A.R.T.) goal (O'Neill, 2000) of using the cup over a period of six weeks. Participants were also advised to keep their written goal somewhere accessible and revisit it if needed. The researcher was there to help participants form an achievable goal and to address any barriers that may arise. In the form of creating an intention and reading it out to the researcher a commitment to it was made (commitment BCT implies affirming participant's goal thus creating a sense of accountability), which is demonstrated to be an effective behaviour change strategy for pro-environmental behaviours (Abrahamse & De Groot, 2013).

   Group 3 – 'Habit'. To increase reusable cup use in the 'Habit' group we used BCTs from "Associations & antecedents" and "Repetition & substitution" domains, restructuring the physical environment, adding objects, prompts or cues and habit formation, correspondingly. These BCTs refer to introducing a cue into the

participant's day-to-day context and repetition of the behaviour. Participants in this group were provided with a choice of a coffee cup they liked most (from six different colour combinations) to increase feeling of ownership of the behaviour. The choice of cue (the colour of the cup) might be able to create a stronger motivation to use the reusable cup (Bartle et al., 2019). Following principles of habit formation (Lally & Gardner, 2013), participants were asked to set a cue for the target behaviour. They were instructed to wash the cup and keep it in a certain (self-chosen) visible spot in their home, so that they would be able to see it before leaving the house, and remember to take it with them.

Group 4 – Control. The control group was told that their consumption of takeaway drinks would be recorded. We utilised a no-treatment control condition in the current study, as we were interested in seeing the difference between no intervention and the three different intervention conditions. They did not receive a cup or any intervention materials at their initial meeting. They received a reusable cup to keep and the information about other intervention groups' contents at six-week follow-up.

Participants

Participants ($N = 156$) were students of a large Australian university, participating either for course credit or in exchange for a gift voucher. Participants who received course credit were recruited through an online university portal. Those who received a gift voucher were recruited via advertisements on the university wide student portal; social media (Facebook); flyers; posters; and snowballing methods. We only recruited participants who consumed hot drinks on campus, did not own a reusable cup, and had a smartphone (required for the app associated with data collection). This sample was chosen because closed environments, such as universities, are particularly suitable environments to introduce a change in behaviour. These environments tend to be more structured, (e.g., students having a preferred coffee shop to attend), compared to open environments such as café strips or tourist places (Poortinga et al., 2019). Overall, participants were between 17 and 52 years old ($M = 22.95$, $SD = 6.43$), and predominantly female (76.9%).

Measures

Identical measures were administered at baseline and at follow-up (6 weeks; see Appendix 6). Demographics were only assessed at baseline (age, gender).

Participants had to provide their student ID number to allow for matching baseline and follow-up data. After matching procedure, all identifying information was removed.

Self-Reported Habit Index (Verplanken & Orbell, 2003). This scale is the most widely used measure that assesses the extent to which a behaviour is habitual. Twelve items such as "Using a reusable hot drink cup is something… I do frequently" or "… I do without thinking" are answered with options between "Strongly disagree" to "Strongly agree" on a seven-point Likert scale. It shows high internal validity $\alpha = .92$ (Verplanken & Orbell, 2003) and for this sample it was also high, between $\alpha = .95$ and $\alpha = .97$.

Intention to use a reusable cup (Ajzen, 2002a) was measured using one item: "I intend to use a reusable cup every day over the next week". The answers ranged from "Strongly disagree" to "Strongly agree" on a seven-point Likert scale.

The biospheric values scale (De Groot & Steg, 2008) consisted of four items from a questionnaire measuring value orientations towards environmental beliefs. Participants could evaluate a value (e.g., "Respecting the earth") on a nine-point scale, ranging from -1 "Opposed to this value" to 7 "This value is extremely important to me", with zero representing the value being not important to the person. The scale showed high internal consistency at $\alpha = .83$ (De Groot & Steg, 2008); for this sample the scores were between $\alpha = .88$ and $\alpha = .89$.

The personal involvement (Verplanken & Roy, 2016) *scale* reflects how interested a person is in the environment, and how much an individual is involved emotionally and empowered within the environmental context. It consists of eight statements on a five-point scale, for example, "I feel like I can really make a contribution to a better environment", with the response options ranging from 1 "Strongly disagree" to 5 "Strongly agree". Internal consistency for this scale is good, $\alpha = .81$ (Verplanken & Roy, 2016); for this sample it is between $\alpha = .80$ and $\alpha = .81$.

Personal norms (Verplanken & Roy, 2016) assesses the norms one might have towards the natural environment. It consists of three statements, such as "Using a reusable cup is something everyone should do", with answers ranging from "Strongly disagree" to "Strongly agree" on a five-point scale. Cronbach's alpha for this measure was good between $\alpha = .78$ and $\alpha = .84$ (Verplanken & Roy, 2016); in this sample it was between $\alpha = .76$ and $\alpha = .83$.

New Environmental Paradigm (NEP) (Stern et al., 1999) measures how concerned one is for the environment with 12 items. Statements, such as "Humans are severely abusing the environment", have a range of response options on a seven-point scale from 1 "Strongly disagree" to 7 "Strongly agree". Cronbach's alpha for this scale was good, $\alpha = .81$ (Dunlap, 2008); for the current sample internal consistency was not as strong $\alpha = .58$ and $\alpha = .66$.

The short version of Intolerance for Uncertainty Scale (Carleton et al., 2007) reflects the tendency to expect a negative event to occur irrespective of how probable it is. Participants respond to 12 items, for example, "Unforeseen events upset me greatly", choosing an option on a five-point Likert scale from 1 "Not at all characteristic of me" to 5 "Entirely characteristic of me". Internal consistency for it was high at $\alpha = .96$ (Carleton et al., 2007); for this sample $\alpha = .93$.

Measure of behaviour. In this intervention, a new way of assessing behaviour was tested. As use of a reusable cup is difficult to observe directly (Gatersleben, 2018), we used an Ecological Momentary Assessment (EMA) phone application "Instant Survey": it is a free application, developed for the purpose of research and easily customisable. It has been extensively used for purposes of EMA within, for example, alcohol (O'Donnell et al., 2019) and body image research (Fuller-Tyszkiewicz et al., 2018). It allows the capture of behaviour frequently and in natural contexts, reducing recollection bias (Shiffman et al., 2008) that is present in retrospective self-report measures (e.g. asking participants to remember how many times they used a reusable cup in the past week; Novoradovskaya et al., 2020). This app also served as a tool for self-monitoring, when participants record and reflect on how many times they actually used their reusable cup, which is an effective BCT for behaviour change and maintenance (Michie et al., 2013), and is the same for all four groups. The app can be installed on a smartphone and sends reminders to complete measures as frequently as the researcher chooses. Participants in our study were asked to download the app from Google Play (Richardson, 2015aa) or iTunes AppStore (Richardson, 2015b) on their smartphones. They received a unique user ID within the app, which was provided to the researcher in the initial meeting and matched with the student's ID number. No other identifying information was used by the app. Instant Survey app then sent notifications twice a day for a week to answer two simple questions; participants completed the questionnaires for one week immediately after

intervention and for one week at six-week follow-up, with a break in-between. The questions were: "How many takeaway hot drinks (e.g., coffee, tea, hot chocolate etc.) have you had today?" and "How many of those have you had in a reusable hot drink cup?" As an answer, they could pick a number from a drop-down menu from 0 to 5+. The control group was also asked what type of beverage they had (e.g., coffee), as participants were told that their consumption of hot drinks was the focus of the study. The outcome score of this measure was calculated by weighting the percentage of times a reusable hot drink cup was used by the overall opportunity to use of a reusable cup (twice a day seven days a week, overall 14 times in one measurement period).

Procedure

Of the sample ($N = 156$) 28.8% were psychology students participating for course credit. All other participants received a gift voucher. Participants were able to access the questionnaire on the Qualtrics platform via either a link or a QR code.

After electronically providing consent and demographic information, the baseline questionnaires were presented in random order. At the end of questionnaire, participants were randomly assigned to one of the four conditions using Qualtrics, and were able to select a convenient time to meet with the researcher.

Participants met with the researcher (EN) in the laboratory, who delivered the intervention and provided the instructions on the behavioural measure and procedure over the next six weeks. Participants were encouraged to record their actual use of a reusable cup rather than a number that they consider socially desirable, which was reinforced by the fact that they could not be identified directly through the app. Each session lasted between 10 and 20 minutes. After the face-to-face component, participants completed the rest of the study online: they received questions on the Instant Survey application twice a day for a week via a notification on their phone, and for another week at six weeks follow-up. After six weeks participants were provided with a brief information sheet on what the other intervention conditions comprised. Participants in the control group were provided with instruction regarding how they could receive their reusable cup. The Human Research Ethics Committee approved the study prior to its commencement (see Appendix 5).

Results

Initially, 1481 people responded to advertisements and answered questions designed to address the inclusion criteria. A final count of 156 participants provided all the measurements. A flow chart of attrition of participants can be seen in Figure 4.1.
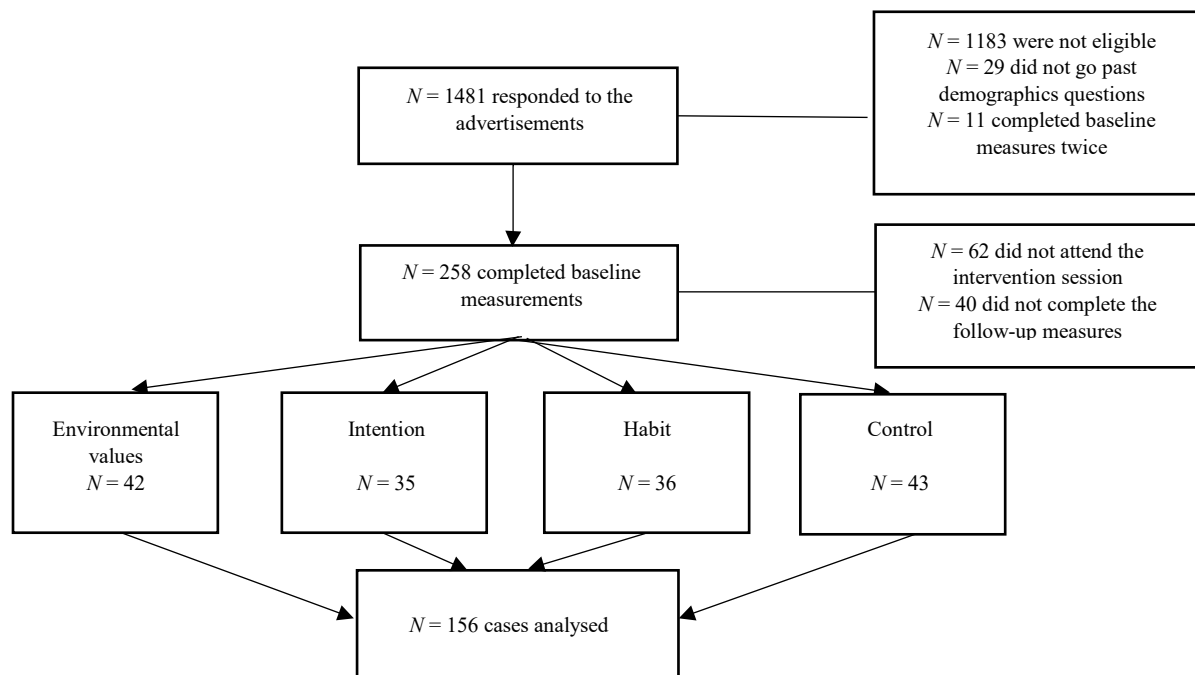
Figure 4.1 Flow chart of the participants from recruitment to analysis.

We compared the two recruitment groups, students of the university who received gift vouchers and those who received study credit (see Table 4.1). They did not differ on gender or whether they were in their first year of studies or not. Groups slightly differed in age, where those who signed up to get a gift voucher ($M = 23.64$, $SD = 7.05$) were on average 2 years older than those who signed up for study points ($M = 21.24$, $SD = 4.16$). We also tested, whether as the result of randomisation procedure, participants from the two recruitment groups were equally spread across the four intervention conditions, and observed an even distribution across conditions.

Correlation matrices for all variables at all time points can be seen in Appendix 7 (Tables 4.2-4.4).

Table 4.1 Differences in demographic characteristics between participants' recruitment groups

Variables	Course Credit ($N = 45$)	Voucher ($N = 111$)
Gender		
Female (N)	34	86
Male (N)	11	24
Other gender	0	1
Chi square	.535	
First year		
N	36	97
t	.401	
Age		
$M \pm SD$	21.24 ± 4.16	23.64 ± 7.05
t	**-2.131***	
Intervention group		
Values (N)	13	29
Intention (N)	13	22
Habit (N)	9	27
Control (N)	10	33
Chi square (N)	2.179	

* significant at $p < .05$.

Effects of Intervention: Mixed Model ANOVA

A mixed model analysis of variance was conducted to establish the effect of the three different interventions (Environmental Values, Intention, Habit) and the Control condition on the use of a reusable hot drink cup. We also assessed changes in habit strength, intention to use a hot drink cup, and four different environmental measures, across two time points, as these constructs were hypothesised to be the mechanisms underlying behaviour change.

Assumptions for mixed model ANOVA were tested and met, except the dependent variable (use of reusable cup), which had deviations from normality in the distribution. Moreover, some outliers were present in several independent variables.

We applied transformations for the data, however, that neither corrected for the normality of distribution within the outcome variable, nor removed the outliers from all the transformed variables and did not change the results obtained. We decided to analyse the non-transformed data for ease of interpretation.

There was a significant main effect of time, indicating that there was a change in behaviour over time. There was no main effect of intervention group, which indicated that there was no overall effect of belonging to one or the other treatment condition on the outcomes. There was a significant interaction between the intervention condition and time (see Table 4.5).

Univariate analyses revealed the effect of time was evident for all outcome variables but one (all $p < .006$; New Environmental Paradigm $p = .08$). The following measures significantly increased over time: habit strength, intention, biospheric values, personal involvement, and personal norms. Only New Environmental Paradigm scale scores did not demonstrate a significant change from baseline to follow-up (Table 4.6). The use of a reusable cup significantly decreased from 29% at first data collection to 26% at the second.

When exploring the interaction between time and intervention condition, a significant change was found only for two outcome variables, habit strength and behaviour.

Effects of Intervention: Difference between Treatment Conditions

We ran simple main effects, using one-way ANOVAs, to understand how treatment groups differed, at each time point, on the outcome variables. At baseline, scores on habit strength did not differ between treatment groups (see Table 4.7). However, a difference between groups was evident at follow-up. Post hoc analysis using Tukey's HSD (at α level of .05) demonstrated that members of Environmental Values, Intention, and Habit groups scored significantly higher than members of

Table 4.5 Results of mixed model ANOVA

	Wilk's lambda	F	df	p	η^2_p
Main effects:					
Time	.479	22.71	7, 146	**<.001*****	.521
Intervention group	.825	1.39	21, 420	.118	.062
Interaction effects:					
Time x Intervention group	.636	3.41	21, 444	**<.001*****	.140
Habit strength		10.78	3, 152	**<.001*****	.175
Intention		2.03	3, 152	.112	.039
Biovalues		1.18	3, 152	.321	.023
Personal involvement		1.05	3, 152	.374	.020
Personal norms		2.45	3, 152	.066	.046
New environmental paradigm		1.25	3, 152	.295	.024
Behaviour		6.13	3, 152	**.001****	.108

Notes: *** significant at $p < 0.001$

Table 4.6 Univariate statistics for effect of time on all outcome variables

Outcome	Baseline		Follow-up		95% CI for Mean Difference	t
	M	SD	M	SD		
Habit strength	2.63	1.09	3.81	1.51	-1.43, -1	**-11.06*****
Intention	4.42	1.64	5.15	1.66	-1.04, -0.46	**5.12*****
Biovalues	7.46	1.11	7.73	1.04	-0.43, -0.1	**-3.16****
Personal involvement	3.74	0.59	3.86	0.55	-0.19, -0.03	**-2.73****
Personal norms	4.01	0.62	4.33	0.61	-0.34, -0.14	**-4.8*****
New environmental paradigm	5.59	0.81	5.71	0.85	-0.24, 0.1	1.8
Behaviour	28.92	28.63	25.89	30.73	1.03, 5.87	**-2.82****

Notes: *** significant at $p < 0.001$; ** significant at $p < 0.01$.

Table 4.7 Difference between all treatment conditions at two time-points (One-way ANOVA)

Variable	Time	F	df	p	η^2_p	Environmental values ($N = 42$)	Intention ($N = 35$)	Habit ($N = 36$)	Control ($N = 43$)
						$M \pm SD$	$M \pm SD$	$M \pm SD$	$M \pm SD$
Habit strength	Baseline	0.65	3, 152	.581	.013				
	Follow-up	6.81	3, 152	**<.001*****	.118	4.15 ± 1.37	4.23 ± 1.38	4.01 ± 1.56	2.98 ± 1.41
Intention	Baseline	.18	3, 152	.910	.004				
	Follow-up	3.39	3, 152	.020*	.063				
Biovalues	Baseline	1.58	3, 152	.198	.030				
	Follow-up	.91	3, 152	.438	.018				
Personal involvement	Baseline	.08	3, 152	.968	.002				
	Follow-up	1.43	3, 152	.236	.027				
Personal norms	Baseline	1.13	3, 152	.339	.022				
	Follow-up	3.11	3, 152	.028*	.058				
New environmental paradigm	Baseline	.78	3, 152	.506	.015				
	Follow-up	2.51	3, 152	.061	.047				
Behaviour	Baseline	6.18	3, 152	**.001****	.109	35.58 ± 29.9	36.18 ± 26.57	32.08 ± 27.98	13.86 ± 24.48
	Follow-up	2.75	3, 152	**.045***	.052	34.58 ± 34.98	30.19 ± 30.75	21.73 ± 26.3	17.4 ± 27.72

Notes: *** significant at $p < 0.001$; * significant at $p < 0.05$.

Control group, but did not significantly differ from each other. Simple effects analysis using one-way ANOVA was also performed for the behaviour measures. The ANOVA was significant for behaviour immediately after the intervention, with post hoc tests showing all intervention groups recording greater reusable cup use than participants in the control condition, but with no differences between the intervention groups. Environmental Values, Intention and Habit groups had significantly higher scores than the Control group. This effect remained at follow-up. Post hoc analysis with Tukey's HSD (at α level of .05) demonstrated that only participants of the Environmental Values group were significantly different from the Control condition. Intention and Habit groups were not significantly different between each other or from the other groups (see Table 4.7).

Effects of Intervention: Difference within Treatment Conditions

Paired samples t-tests were conducted to determine if there was a significant change within each of the treatment groups from time one to time two in habit strength and behaviour. Within the Environmental Values group, all measures except behaviour significantly increased from baseline to follow-up (see Table 4.8). In the Intention group habit strength, intention, and personal norms significantly increased from baseline to follow-up (see Table 4.9). In the Habit group, habit strength and intention significantly increased from baseline to follow-up, and behaviour significantly declined from post-intervention to follow-up (see Table 4.10). The Control group demonstrated no change in any scores on psychological measures, but showed a significant increase in behaviour scores from post-intervention to follow-up (see Table 4.11).

Table 4.8 Descriptive Statistics and t-test Results for Environmental Values group ($N = 42$) for all outcomes

Outcome	Baseline		Follow-up		95% CI for Mean Difference	t
	M	SD	M	SD		
Habit strength	2.5	1.03	4.15	1.37	-2.14, -1.14	-6.26***
Intention	4.52	1.46	5.33	1.46	-1.4, -0.217	**-2.76***
Biovalues	7.40	1.21	7.87	0.10	-0.77, -1.61	**-3.09***
Personal involvement	3.76	0.62	3.10	0.59	-0.39, -0.07	**-2.84***
Personal norms	4.14	0.62	4.51	0.51	-0.55, -0.18	**-3.93***
New environmental paradigm	5.67	0.75	5.99	0.75	-0.55, -0.08	**-2.75***
Behaviour	35.58	29.9	34.58	34.98	-4.48, 6.49	0.37

Notes: *** significant at $p < 0.001$; * significant at $p < 0.05$.

Table 4.9 Descriptive Statistics and t-test Results for Intention group ($N = 35$) for all outcomes

Outcome	Baseline		Follow-up		95% CI for Mean Difference	t
	M	SD	M	SD		
Habit strength	2.67	1.10	4.22	1.38	-1.95, -1.16	**-8.04*****
Intention	4.51	1.56	5.34	1.77	-1.44, -0.219	**-2.76***
Biovalues	7.34	1.19	7.66	0.90	-0.68, -0.02	-1.91
Personal involvement	3.72	0.59	3.78	0.54	-0.25, -0.12	-0.67
Personal norms	3.95	0.65	4.31	0.69	-0.58, -0.14	**-3.33***
New environmental paradigm	5.41	0.84	5.47	0.86	-0.34, 0.22	-0.46
Behaviour	36.18	26.57	30.19	30.75	-0.44, 12.41	1.89

Notes: *** significant at $p < 0.001$; * significant at $p < 0.05$.

Table 4.10 Descriptive Statistics and t-test Results for Habit group ($N = 36$) for all outcomes

Outcome	Baseline		Follow-up		95% CI for Mean Difference	t
	M	SD	M	SD		
Habit strength	2.53	1.23	4.01	1.56	-1.96, -1.02	**-6.42*****
Intention	4.36	1.69	5.53	1.58	-1.76, -0.58	**-4.0*****
Biovalues	7.8	0.90	7.83	0.19	-0.36, 0.29	-0.217
Personal involvement	3.77	0.60	3.87	0.58	-0.28, 0.07	-1.16
Personal norms	4.21	0.61	4.40	0.66	-0.42, 0.05	-1.62
New environmental paradigm	5.59	0.81	5.66	0.98	-0.41, 0.29	-0.36
Behaviour	32.08	27.97	21.73	26.3	6.1, 14.6	**4.95*****

Notes: *** significant at $p < 0.001$.

Table 4.11 Descriptive Statistics and t-test Results for Control group ($N = 43$) for all outcomes

Outcome	Baseline		Follow-up		95% CI for Mean Difference	t
	M	SD	M	SD		
Habit strength	2.80	1.05	2.98	1.41	-0.56, 0.20	-0.95
Intention	4.30	1.73	4.49	1.68	-0.75, 0.38	-0.67
Biovalues	7.31	1.06	7.53	1.06	-0.58, 0.14	-1.24
Personal involvement	3.72	0.59	3.77	0.48	-0.19, 0.08	-0.87
Personal norms	4.08	0.62	4.12	0.55	-0.23, 0.13	-0.52
New environmental paradigm	5.65	0.84	5.66	0.79	-0.18, 0.15	-0.17
Behaviour	13.86	24.48	17.40	27.72	-6.95, 0.13	**-2.09***

* $p < .05$.

Mechanisms of Behaviour Change: Moderated Mediation

Next, we explored the potential mechanisms by which the intervention groups increased behaviour, testing the indirect effect of interventions on behaviour through habit strength, intention, and four environment related measures. In addition, we tested whether intolerance of uncertainty moderated the relationships between these proposed mechanisms and behaviour. As there was no intervention effect across groups, we combined the three intervention groups into one, and compared it with the control group. We tested a moderated mediation model 14 using SPSS PROCESS (Hayes, 2017). There was a direct effect of intervention group on intention, habit strength, and personal norms, but not on any other mediators. There was no direct effect of belonging to the intervention group on behaviour. There was an indirect effect of intervention on behaviour, through habit strength. Habit strength was the only proposed mediator to have a direct relationship with behaviour. The results are presented in Figure 4.2.
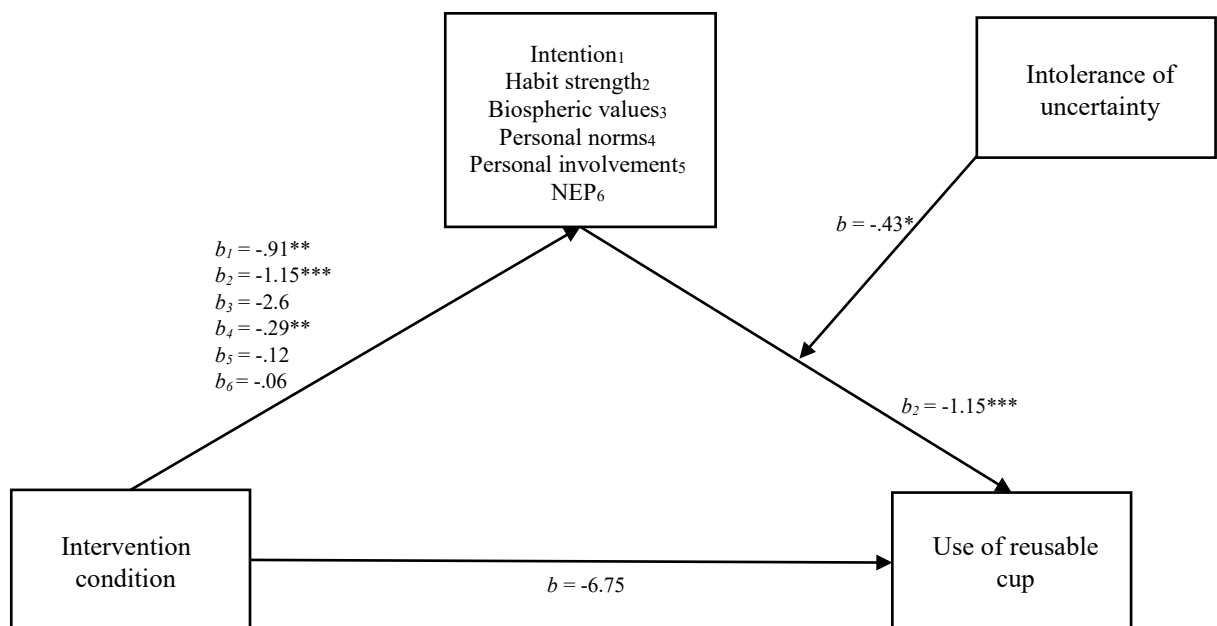
Figure 4.2 Model 14 of moderated mediation, intervention condition is the predictor, habit strength, intention, environmental measures are mediators, intolerance of uncertainty is a moderator and use of reusable cup is the independent variable (Hayes, 2017).

Notes. * $p < .05$, ** $p < .01$, *** $p < .001$

Finally intolerance of uncertainty moderated the relationship between habit strength and behaviour. The relationship is illustrated in Figure 4.3. A positive relationship between habit strength and behaviour was observed at high levels of intolerance of uncertainty, and at medium levels, but not at low levels.
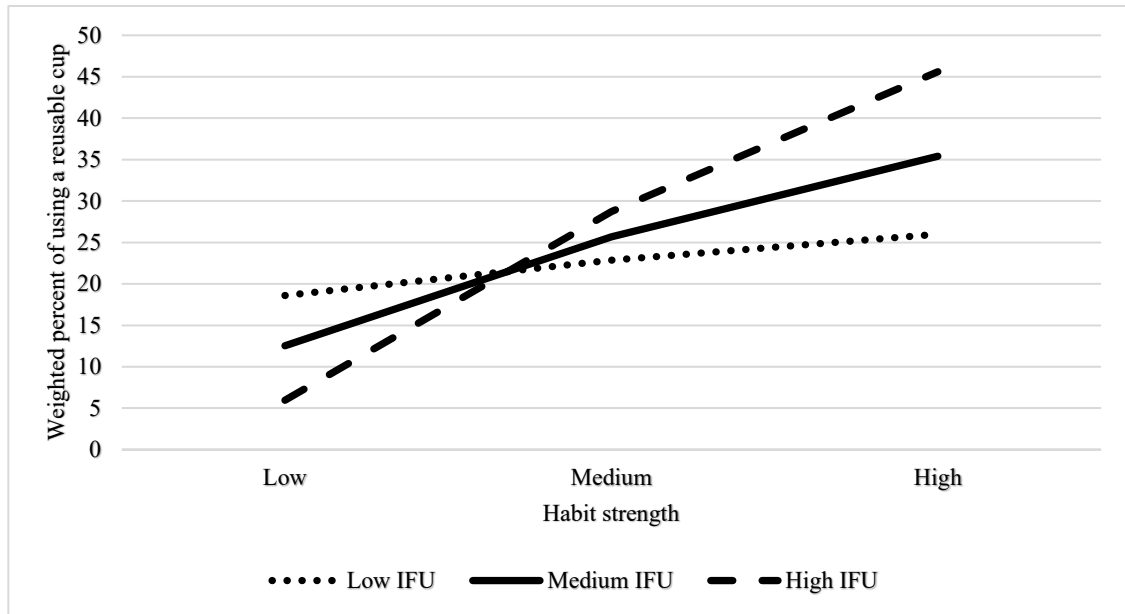
Figure 4.3 Habit strength has a moderating effect on relationship between intolerance of uncertainty (IFU) and using a reusable cup: for those intolerant for uncertainty higher levels of habit strength are predictive of behaviour of using a reusable cup.

Discussion

An intervention to increase the use of reusable hot drink cups among students on a large Australian university campus was conducted to broaden understanding of ways to effect and maintain the change. The results of the intervention demonstrate that providing participants with an intervention, regardless of its contents, is sufficient to change the behaviour of using a reusable cup. There was a significant difference between all intervention groups and the control group immediately after the intervention, where all three intervention conditions demonstrated almost 2.5 times greater use of the reusable cups compared to participants in the control group. At six-week follow-up, only participants in the Environmental Values group maintained their high use of the cup, with behaviour slightly reduced in the Intention group and significantly reduced in the Habit group. Previous research has demonstrated that provision of any intervention, or even just behavioural monitoring, can produce behaviour change in simple behaviours (Bartle et al., 2019; Mullan et al., 2014). The

provision of cups alone may explain the immediate change in the behaviour, as it is unlikely an individual would use a reusable cup without having one (Poortinga et al., 2019). This can serve as the first recommendation for effective behaviour change when it comes to reusable alternatives: making the item freely available may be a first step to increase this behaviour. In the current research, participants in the control condition did not receive a reusable cup. In order to understand the influence of the cup alone, future research may compare the provision of the reusable cup with and without a behaviour change intervention.

The decrease in behaviour from intervention through to follow-up is a commonly observed trend in behaviour change research (Kwasnicka et al., 2016). Successful maintenance of behaviour in the Environmental Values group has several potential explanations. Firstly, environmental values are not easily changed, especially within such a short intervention, but they can be activated with provision of relevant information resources (Abrahamse & De Groot, 2013). The content of the video used, if unknown, can be quite shocking and, together with provision of a reusable cup, could have activated values with regard to the environment and helped in maintenance of behaviour over time. Secondly, participants in the control group increased their reported use of a reusable cup, which reduced the gap between the intervention groups and the control group at follow-up, although this difference was only apparent for the habit group. Finally, we only assessed use of the cup on campus; we did not ask participants to report the days they stayed off campus (e.g., due to illness, semester break, not having lectures, or choosing not to come). As students started the intervention at different times of the semester, the measurement weeks might have overlapped with non-average semester weeks. Due to these circumstances the recorded use of reusable cups may have been different from use during an average campus week.

Participants in the Control group significantly increased their use of a reusable cup from baseline to follow-up, despite not being given a reusable cup, which may be explained by the effects of monitoring their behaviour (Michie et al., 2009). The only common BCT between all four intervention groups was monitoring (feedback and behaviour BCT), which is known to lead to an increase in behaviour (Michie et al., 2013). For one week at the beginning of the intervention and for one week after six weeks participants had to answer questions about their consumption of hot drinks,

as well as if they used a paper cup or not. The fact that they were asked the question may have affected their awareness of their behaviour and thus changed it (Steg & Vlek, 2009).

We also observed a significant overall increase in all the psychological variables, but one, from baseline measures to the follow-up in all intervention conditions. The construct of ecological worldview, reflected in the New Environmental Paradigm scale (Dunlap, 2008), demonstrated no change from baseline to follow-up. This may indicate that this construct is more trait-like and stable, unlike the other environmental constructs we assessed (Stern et al., 1995). We also established that the internal consistency of this measure in the current study was poor compared to the scores obtained in the study that was originally cited (Dunlap, 2008). We conducted a further search of the literature and discovered that in a meta-analysis of the studies using New Environmental Paradigm the reported Cronbach's alpha was below considered acceptability rates in 39 out of 78 studies (Hawcroft & Milfont, 2010). Future research is needed to look into the possible reasons for the internal consistency of this scale varying between various samples.

Within the Environmental Values group, all the psychological variables increased from baseline to follow-up, even the ecological worldview scores. This might be explained by the impactful information within the video and the interest that it evoked in participants. The information might have been so impactful, as to actually affect the ecological worldview within this group. The Intention group demonstrated increase in habit strength, intention, and personal norms. This group was not provided with specific information about how paper cups affect the environment either, but rather with directions for setting and following through with a goal, which might be the reason that the environmental variables did not demonstrate change. Members of the Habit group demonstrated increases in habit strength and intention. This group was also not provided with any specific environmental impact information; hence, there was no increase in the environmental outcomes. The increase in both habit strength and intention can occur, as habits can be formed based on intention (Klöckner, 2013; Mullan & Novoradovskaya, 2018). The correlation between intention and habit strength at follow-up is strong. In this case, in order to form a habit of using a reusable cup, a participant's intention to do so may still be strong until the behaviour becomes less conscious and more automatic due to frequent

repetition. Future research could explore if change in intention precedes change in habit strength.

Habit strength significantly increased in all intervention groups and we found that it was the only significant psychological mechanism that mediated the relationship between intervention condition and behaviour. In other words, behaviour change happened through the mechanism of habit in all intervention groups. This result has quite a significant practical implication, that by developing habit strength, the behaviour is most likely to change and the change maintained. Participants in all intervention conditions were provided with a reusable cup and were asked to report their behaviour for 14 days, which made the repetition of behaviour possible and may have served as a cue. This may have increased the repetition of behaviour within the stable context of the university campus. The behaviour is also rewarded with discounts on drinks bought in the reusable cup at most locations on campus, however these discounts have demonstrated limited effects on the use of reusable hot drink cups (Poortinga & Whitaker, 2018). It is important to acknowledge that being given a reusable cup or self-monitoring may have also been important mechanisms of behaviour change. They can be tested in future interventions as other potential contributors through which change happens in this particular behaviour.

Belonging to an intervention group appears to affect reusable cup use through an increase in habit strength, but this relationship influenced behaviour only for those with higher levels of intolerance of uncertainty. We were able to replicate the relationship we found previously (Novoradovskaya et al., 2020), where there was an association between the use of the reusable cup and stronger habit but only for those intolerant of uncertainty (see Figure 3.3). For those who have trouble withstanding uncertainty in life, habits and, consequentially, habitual behaviours, might be a way to cope with this uncertainty. This may help in tailoring interventions: those with higher levels of intolerance of uncertainty might benefit more from habit-based interventions.

The current study adds to the existing body of literature on behaviour change interventions for pro-environmental behaviours (for reviews see Byerly et al., 2018; Steg & Vlek, 2009; Yuriev et al., 2018). The only previous reported intervention on promoting the use of reusable cups was focused on changes in the environment, such as changes in prices, availability of reusable options and provision of information

(Poortinga & Whitaker, 2018), whereas our study contributes to the individual behaviour change context. The current research expands on the role habit can play in promotion of pro-environmental behaviours, which was reflected in such behaviours as recycling (Comber & Thieme, 2013; Holland et al., 2006), using a bicycle instead of a car to commute (Gardner, 2009), or saving energy (De Vries et al., 2011). Promoting habit formation for pro-environmental behaviours, thus, is a promising avenue for future behaviour change intervention development.

Strengths and Limitations

The intervention that was developed and implemented is the first of its kind, evaluating the effectiveness of three different treatment conditions on the use of a reusable hot drink cup. We confirmed, as was demonstrated in broader studies (Poortinga & Whitaker, 2018), giving a cup to students and monitoring their behaviour is a feasible way to increase behaviour. We demonstrated that habit strength is the predominant mechanism of behaviour change within the intervention. We also replicated a previous finding of intolerance of uncertainty being connected with strength of habit and an eco-friendly behaviour.

Among the limitations of the study measurement was an issue. We could not control for when the follow-up measurements of behaviour happened, and some participants may have been on a semester break, away, sick or absent from campus during that week. As participants might have different routines with regard to drinking hot drinks off campus, the use of reusable cups might have been underestimated. In future research the initial intervention and measurement could be provided at the same time of the semester for all participants or by adjusting the time of follow-up according to the weeks off campus.

Conclusions

A behaviour change intervention, to increase the use of a reusable hot drink cup, was conducted and a significant increase in the target behaviour was achieved immediately after the intervention compared with the control condition. Regardless of the contents of the intervention, participants used their reusable cups more, and did it via an increase in habit strength. For the long-term maintenance of behaviour, provision of information on the impacts of the non-sustainable behaviour might need to be paired with offering a solution to the problem (a free reusable cup).

There are theoretical and practical implications of the current study. The concept of habit may be useful in the development of behaviour change interventions, which may inform further research within habit and environmental psychology. Further research is needed to see whether this concept is appropriate for other sustainable behaviours, and can help to develop habit-based interventions for those intolerant of uncertainty. In terms of broader application of the findings, we recommend providing information to activate environmental values at the same time as providing reusable cups to campus students free of charge to create a habit and ultimately to decrease the amount of landfill waste, with the ultimate goal of abandoning single-use cups.

Chapter 5. Acceptability of a Behaviour Change Intervention Aimed at Increasing the Use of a Reusable Hot Drink Cup

The final study of phase two, and of the thesis, is aimed at evaluating the intervention. It is important to critically assess the process of intervention development and delivery in order to be able to improve aspects of the program and successfully apply the efforts to other similar pro-environmental behaviours. The current study is implemented using a mixed methods approach, where participants of the intervention are able to reflect upon the contents of the intervention and the methods used. Moreover, the researcher's reflections are taken into consideration. Based on this information future recommendations are made in order to improve the delivery of similar interventions and its effectiveness and cost-effectiveness.

Author	Contribution	I acknowledge that these represent my contribution to the above research output. Signed:
Elizaveta Novoradovskaya	Conceptualisation, Methodology, Data Analysis, Investigation, Data Curation, Writing, Project administration	
Barbara Mullan	Assisted in Conceptualization, Methodology, Writing - Review & Editing, Supervision.	
Penelope Hasking	Assisted in Conceptualization, Methodology, Writing - Review & Editing, Supervision	

Abstract

It is beneficial for the planet if we engage in more sustainable behaviours, such as using reusable items instead of single-use ones, thus reducing plastic pollution. An intervention to increase the use of reusable coffee cups was implemented, by employing behaviour change techniques that targeted values towards environment, intention to use a reusable cup, and habit. The intervention was successful in increasing the participants' use of reusable cups. The aim of the current study was to evaluate the acceptability of the intervention using a mixed methods approach. Participants ($N = 156$) answered open and closed survey questions about the acceptability of the intervention, and 11 participated in interviews regarding their experience of intervention. The intervention was deemed acceptable and useful by all participants, regardless of which intervention condition they were allocated to, according to both survey and interview data. Recommendations for implementing similar interventions and future research are offered.

Introduction

Environmental pollution is an acute issue, especially when it comes to plastic waste. Oceans and landfills are full of everyday items, such as paper coffee and tea cups (Lenaghan, 2017; Suskevice & Grönman, 2019). Paper cups are widely thought to be recyclable; however, the paper is covered on the inside with a plastic film in order to prevent leaking, which makes paper cups unsuitable for general recycling (Ziada, 2009). As coffee-on-the-go is very popular, some solutions to the waste problem are needed. One of the possible answers is using a reusable hot drink cup instead of a disposable one (Poortinga et al., 2019).

The importance of educating consumers about available reusable options, as well as effective behaviour change solutions, have been outlined and demonstrated in a successful large-scale intervention in the UK (Poortinga & Whitaker, 2018). Several office buildings and university campuses applied a variety of measures to increase the use of reusable cups: they put up informational posters, offered reusable cups for sale or free of charge to customers, and substituted discounts for bringing your own cup with charges on purchasing a paper cup. The intervention showed promising results with the use of reusable cups increasing and change maintained over a 10 months period. The authors also emphasized that implementing such interventions is most efficient within closed environments, such as campuses or office spaces, where people tend to spend a lot of time, have preferences for attending certain places (e.g., cafes) and have set routines.

We developed and implemented an intervention to increase the use of reusable cups in a population of university students, targeting individual behaviour change (Novoradovskaya et al., 2021). The aim was not only to change behaviour, but also to find out what mechanisms might underlie the behaviour change, as it is important for developing future behaviour change and educational interventions. The intervention had three treatment conditions and a control group. The treatment conditions targeted three different mechanisms known to underlie behaviour change (Novoradovskaya et al., 2021) using appropriate behaviour change techniques (Michie et al., 2013). All of the participants also received a new reusable cup. The environmental values group watched a short video exempt from BBC TV show "War on Waste" (BBC, 2016) providing knowledge on how paper cups are being discarded. This targeted participants' values towards the environment. The intention group were

asked to set a SMART goal (O'Neill, 2000) for the duration of the intervention to increase their use of a reusable cup. Finally, the habit group was able to choose the colour of the cup, and was instructed to place it in a self-chosen salient location in their home to serve as a cue to the behaviour (Lally & Gardner, 2013). The control condition did not receive an intervention but did receive a reusable cup after the intervention was over. All groups reported their behaviour of using a reusable cup through a phone application Instant Survey (Richardson, 2015a, 2015b) during the first and last weeks of the intervention (six weeks apart). Full details of the intervention and measurements are described elsewhere (Novoradovskaya et al., 2021).

All intervention groups demonstrated a significant increase in their use of a reusable cup immediately after the intervention. The environmental values and intention groups maintained that level of behaviour at six-week follow-up. We also discovered that the mechanism of change in all the groups was habit strength: independent of the intervention content, behaviour increased through forming a habit to use a reusable cup. This intervention demonstrated promising results, as there was significant behaviour change, and, as this happened through the mechanism of developing a strong habit, it is likely to be maintained in the long-term (Kwasnicka et al., 2016).

Despite these promising results it is important to evaluate the implementation of the intervention in order to improve future efforts in this area of research and determine what was effective and what could be improved upon or simplified (Steg & Vlek, 2009). Evaluation of the acceptability of this intervention may allow for possible future application of this intervention to other behaviours or for improving the intervention for wider delivery.

The aim of this study was to evaluate the acceptability of the intervention to increase the use of reusable cups by university students. The study took a mixed methods approach, combining survey answers and qualitative evidence from open-ended questions and interview data. We investigated whether members of different intervention groups had differing views on the acceptability of the intervention. We also aimed to explore whether participants of differing age and gender would evaluate the intervention differently. The main research question was: what were participants'

opinions about the intervention contents, the procedure, outcomes and effectiveness of the intervention?

Methods

Quantitative Strand

Participants and Procedure

Participants in this study were those who completed the behaviour change intervention mentioned above. As part of the follow-up questionnaire, participants were asked to answer questions about the content and perceived effectiveness of the intervention as well as their thoughts about the Instant Survey phone app they used. They were also asked if they would like to participate in a short interview about the intervention. All of the intervention completers answered the acceptability questionnaires ($N = 156$). Eleven participants took part in a short interview: five from the environmental values condition, two from the intention condition, four from the habit condition and one from the control condition. The study was approved by Human Ethics Research Committee for both quantitative and qualitative strands (see Appendix 5).

Measures

Survey. The acceptability measure consisted of seven questions addressing the content of the intervention. The general statement "Did you find the intervention content…" was followed by characteristics: useful, interesting, credible, easy to understand, personally relevant, too long, and annoying. Participants were asked to state their agreement/disagreement with the statement on a 7-point Likert scale from "strongly disagree" to "strongly agree". There was also space for leaving additional text comments.

The acceptability of the Instant Survey app was evaluated using three items. Participants were asked to evaluate the Instant Survey on three characteristics, whether it was annoying, easy, and useful. Responses were on a 7-point scale from "strongly disagree" to "strongly agree". A free-text space was also provided for any additional comments. Examples of the questions can be found in Appendix 6.

Interviews

Participants who expressed interest in participating in an exit interview were contacted via email. A research assistant separate from the main research team conducted the interviews as some of the participants were still undergoing the intervention, while others had completed the final surveys. This reduced the possibility that the principal investigator could have inadvertently changed the intervention procedure after hearing some of the feedback. Interviews were conducted via Skype and took between 10 and 20 minutes.

A mutual time was agreed upon between the research assistant and the participant to conduct the structured interviews. All interviews were audio recorded and transcribed verbatim.

Researcher's Reflections on Implementation Process

Factors that might have influenced the process of implementation, fidelity and outcomes of the intervention were documented by the first author. During the entire period of design, data collection and analysis, the researcher diarized the problems and considerations that arose during the research process.

Results

We considered the options "strongly agree", "agree" and "somewhat agree" as a general score of agreement with a survey statement, and the three dimensions of disagreement ("strongly disagree", "disagree" and "somewhat disagree") as disagreement, with an option of being "unsure" constituting the third dimension of the responses. We assessed whether there were any differences between intervention conditions on the satisfaction with the intervention contents. Possible differences based on demographic characteristics (age and gender) were also assessed for intervention content as well as the Instant Survey measure.

Intervention Content

Overall, participants were satisfied with the intervention content (see Table 5.1). We analysed the answers about intervention content within each intervention group: environmental values ($N = 42$), intention ($N = 35$), habit ($N = 36$), and control condition ($N = 43$). Responses to whether the intervention was useful, interesting, credible, easy, relevant, long, and annoying were compared between groups using chi square test of contingencies. As the expected count in eight cells was less than 5, the Fisher's exact test was assessed instead. Out of seven dimensions of intervention acceptability, there were only two where a significant difference between groups was

found. The relevance of the intervention significantly differed across groups (Fisher's exact test = 14.47, p = .005, two-sided). Evaluating standardized residuals demonstrated that the environmental values group agreed on the relevance of the intervention in 100% of the cases (standardized residual for 'not sure' = -1.9, which means that less than expected number of people chose this response option), with no participants expressing disagreement or being unsure about the intervention being personally relevant. Thoughts on intervention length also varied across groups (Fisher's exact test = 18.82, p = .001, two-sided). Evaluating standardized residuals showed that the control group evaluated the intervention as being too long (standard residual for 'agree' for control group = 2.6 with more people choosing this option than expected), compared to the intervention condition participants, who mainly evaluated the intervention as not being too long.

Table 5.1 Sample means and percentage of agreement with statements about the intervention content.

	Overall sample mean	% Agree Overall	Environmental values group % agree	Intention group % agree	Habit group % agree	Control group % agree
Useful	5.86	89.7	100	85.7	88.9	83.7
Interesting	5.88	89.7	100	85.7	88.9	83.7
Credible	5.92	90.4	95.2	85.7	91.7	88.4
Easy to understand	6.35	98.7	100	100	97.2	97.7
Personally relevant	5.90	88.5	100	80	88.9	83.7
Long	2.48	6.4	4.8	2.9	0	16.3
Annoying	2.01	11.5	0	5.7	0	11.6

Using chi square test of contingencies we also assessed whether there were any differences by gender in the way the intervention content was evaluated (see Table 5.2). As the expected count in several cells was less than 5, the Fisher's exact test was assessed instead. The participants were predominantly female (76.9%, N = 120). One participant indicated their gender as "other", and had to be excluded from the analysis due to being the only participant in the group. Male and female participants differed only on how they evaluated the relevance of the intervention, with males reporting the intervention as slightly less relevant, than females (Fisher's exact test = 6.818, p = .024, two-sided; standardized residual for "disagree" among males = 1.8, which is higher than the expected count).

Table 5.2 Percentage of agreement with statements about the intervention contents based on gender.

		% agree	% disagree
Useful	Male	88.6	2.9
	Female	90	3.3
Interesting	Male	85.7	8.6
	Female	90.8	1.7
Credible	Male	94.3	0
	Female	90	0.8
Easy to understand	Male	100	0
	Female	98.3	0.8
Personally relevant	Male	77.1	8.6
	Female	92.5	1.7
Long	Male	2.9	94.3
	Female	5	90
Annoying	Male	2.9	7.5
	Female	80	82.5

We investigated whether there were significant differences in how the intervention was evaluated by participants of different ages. We had to exclude one participant from the analysis, as they incorrectly indicated their age as "4" years old. One-way ANOVAs demonstrated no significant differences between how the intervention contents was evaluated, apart from two questions: how useful and how easy the intervention was. Omnibus ANOVA demonstrated a significant difference is present between how participants of different ages evaluate the usefulness of intervention F (2, 152) = 3.171, p = .045. However, planned comparisons and post-hoc tests were not able to detect where the difference lies, as the two out of three groups had very small sample sizes (see Table 5.4). Participants significantly differed in their evaluation of how easy the intervention was, F (2, 152) = 3.403, p = .036 (see Table 5.3). Considering that 154 participants evaluated the intervention as easy, one evaluated it as not easy, and one was not sure, the statistical difference between any of the three answers does not provide meaningful practical significance.

Table 5.3 Differences between how participants of different age evaluated the content of the intervention (one-way ANOVAs).

	df	F	η^2	p
Useful	2, 152	3.171*	0.04	**.045**
Interesting	2, 152	2.475	0.03	.088
Credible	2, 152	1.737	0.02	.179
Easy to understand	2, 152	3.403*	0.04	**.036**
Personally relevant	2, 152	1.128	0.01	.326
Long	2, 152	1.733	0.02	.180
Annoying	2, 152	0.879	0.01	.417

Note. * significant at $p < 0.05$

Table 5.4 Differences between responses of participants by age based on significant omnibus ANOVAs (planned comparisons).

Useful	N	M	SD	95% CI	t
Agree	139	22.65	6.04	21.64, 23.67	
Disagree	5	27.80	8.87	16.78, 38.82	
Not sure	11	26.18	6.81	21.61, 30.76	
Agree/Disagree					1.829
Agree/Not sure					-1.822
Disagree/Not sure					.485

Note. * significant at $p < 0.05$

Easy	N	M	SD	95% CI	t
Agree	153	22.98	6.17	21.99, 23.97	
Disagree	1	21.00	-	-	
Not sure	1	39.00	-	-	
Agree/Disagree					-3.97***
Agree/Not sure					-32.10***
Disagree/Not sure					-

Note. *** significant at $p < 0.001$

Instant Survey App

Participants, in general, were satisfied with the use of the app to measure behaviour (see Table 5.5). We did not test for any significant differences between the intervention conditions, as everyone used Instant Survey application independent of condition.

Table 5.5 Sample means and percentage of agreement with statements about Instant Survey app

	Sample mean	% Agree
Useful	5.67	82.7
Easy	6.04	92.3
Annoying	2.40	78.8

We assessed whether there were any differences between males and females on how they evaluated the intervention using chi square test of contingencies and found no significant differences. One-way ANOVAs were used to assess whether there were any age differences between how Instant Survey app was evaluated with no differences detected (see Table 5.6).

Table 5.6 Differences between how participants of different age evaluated the Instant Survey app (one-way ANOVAs).

	df	F	η^2	p
Useful	2, 152	0.625	0.008	.537
Easy	2, 152	0.917	0.01	.402
Annoying	2, 152	1.664	0.02	.193

Note. * significant at $p < 0.05$

Interviews and Open-ended Survey Questions

Participants had the option of answering two open-ended questions within the follow-up survey, where they could provide comments on the content of the intervention and the Instant Survey app. Eighteen participants provided comments on the intervention content, and 28 participants regarding Instant Survey app. The majority of answers from the open-ended questions of the survey also arose in the interviews, hence, below we present the results from both of those sources together.

Completers were asked to indicate whether they would like to be contacted for exit interviews about the intervention process. Initially 58 participants provided contact information, 23 of whom subsequently responded with an expression of interest in participating. Finally, 11 people participated in the interviews (10 females,

1 male). We were not able to recruit equal or similar numbers of participants from each group: five participants were from the environmental values group, two from the intention group, three from the habit group and one from the control condition. With unequal representation of participants from each condition, results should be considered with caution.

Regarding the intervention content, participants expressed their opinions about being a part of each of the intervention conditions.

Environmental values group. The information in the video was new almost to all participants, and this was also reflected within the open-ended answers to the survey questions. All responders indicated that the content was helpful in raising awareness of environmental problems and in changing the behaviour. One participant said in the interview:

> *I think one thing that really worked was when [researcher] showed me the video, <…> on like the plastic lining on a paper cup and I honestly just never heard of that before, because I always say just to recycle and I was really like woke - uh, woken? – about that. And I did end up sharing - because I asked her for the link afterwards - and I did end up sharing that video with a lot of other people and yeah. So I was like, I did end up using my KeepCup a lot more.*

Intention group. Participants in the intention group found the setting of SMART goals helpful in changing their behaviour. One of the participants reflected on the combination of goal-setting activity and being given a free cup as working out well:

> *… I think [setting a goal] that's kind of motivated me, whereas if I'm buying it [cup] just by myself I'm pretty sure I wouldn't have a goal of using this. I would just buy it and probably forget about it.*

Those who responded to the open-ended questions in the survey reflected on the usefulness of setting goals, with one participant mentioning that the information was, however, not new to them.

Habit group. Participants in the habit group provided information on how and why the intervention seemed to work or not work for them. The choice of the colour of the cup seemed to be appreciated by all the participants, with one of them saying:

... because I'm more likely to use the KeepCup; when I use it I'm like not proud of but when you wear your favourite dresses your emotion feels better, it's in the same mood.

One participant from this group reported that the intervention has not worked for them because of the chosen colour. They reported:

No, I didn't build the habit and I feel that maybe I made the wrong choice selecting. Because I picked a black cup, it actually blends in with my furniture so I feel I should have probably picked a brighter colour cup and then maybe I would have noticed it more to take with me. ... I feel like that would have worked had I picked a better colour cup. See, I kind of looked at the cups and like for my personality, I'm not a very out there bright kind of person so I was like, just pick a black cup.

Other aspects of the intervention. Other comments of participants not specific to the intervention condition were about the helpful aspects of the intervention. The length of the intervention and the amount of contact provided was satisfactory, as was the simplicity of it. The majority of participants highlighted their increase in awareness of environmental issues and their own behaviour in this regard. Some even reported that they do not buy a drink if they forgot their reusable cup at home. One participant reflected: "…it reminds me I'm like an ecofriendly person when I use the KeepCup".

Some other comments that participants provided concerned their coffee consumption, where some of them said they do not consume coffee or hot drinks regularly, or that they drink more during exams and assignments. This was also reflected in the open-ended questions within the survey. In relation to this, some participants expressed that they would not purchase a cup if they were not given one during the intervention, or have never thought of getting one for themselves before. All of the participants expressed appreciation for receiving a reusable cup, with several mentioning that it created a sense of responsibility within them to use the cup. A frequent comment reflected the fact that the follow-up week of Instant Survey questions had in the majority of times coincided with a non-average week for them (tuition free weeks, exams, generally being off campus), which affected the amount of drinks they consumed and use of the cup reported via the app. Other comments addressed the reusable cup that participants were given, including a suggestion to

giveaway a glass cup, not a plastic one, as it is more environmentally friendly and would contribute to plastic pollution reduction. Another comment addressed the size of the cup, where a larger size would be more appreciated by those who drink iced drinks, as they are usually bigger than hot drinks.

Instant Survey app. Half of the participants interviewed stated that the use of the app affected their behaviour, as the notifications to fill in the survey served as reminders to bring a reusable cup and use it. Hence, participants mainly saw the app as part of the intervention, not as measurement. Instant Survey was, almost unanimously, considered easy to use and did not cause any annoyance to the participants. However, a number of issues were reported. The notifications were requested to be on screen longer, as they disappeared after half an hour if the participants did not click on them. Notifications were mostly considered to arrive at convenient times of day (lunchtime and evening), however, sometimes they were received at odd times, even though they were initially programmed to be sent at the same time every day for all participants. A few issues with the interface of the application were also outlined, such as not being able to see the confirmation of answers being recorded: the application would redirect the user to home page after clicking 'Submit' button, or suggesting a brighter colour scheme instead of plain black and white.

Researcher Reflections

The primary researcher kept a log of issues and future suggestions that came up during the implementation of intervention: recruitment, initial meetings with participants, and follow-up period.

Recruitment. During the recruitment phase, strict inclusion criteria were imposed to ensure only those who consume hot drinks on campus, do not own a reusable cup, and own a smartphone were able to participate. It was underestimated how strict the inclusion criteria were, which affected the speed of recruitment. Instead of lasting for only one semester, the recruitment had to be continued in two semesters to meet the numbers. In future research we recommend recruitment be extended outside of the one university campus to other universities in the area, which would allow recruitment of participants in an anticipated timeframe.

Participants were asked whether they consume hot takeaway drinks on campus as a part of the inclusion criteria questions. When participants came to the

initial face-to-face meeting or further during data collection, it appeared, in a few cases, that hot drinks were consumed occasionally, for example, less than once a week. As our measures of behaviour only assessed one week at two time points, the consumption of hot drinks may have not been recorded with such an infrequent consumption.

Implementation of intervention. The issues that came up during the implementation of intervention mainly concerned the attendance at sessions and technological issues. Participants, after signing up for an intervention time-slot, were sent a reminder of the time and place of the intervention meeting via email one or two days prior. University students are generally advised to check their student emails regularly, thus we anticipated a high probability of reading the reminder. The intervention recruitment numbers demonstrated that almost a third of all participants who signed up for a time slot failed to come to the appointment. In the majority of cases, the researcher was not informed of the cancellation. That resulted in a waste of time resources (about 17 hours altogether face-to face time), as the researcher was waiting for the participant, who never arrived. The 'no-show' was prevalent among the participants who enrolled through general recruitment strategies (for a monetary reward), rather than participants who participated for study credit. For those who were willing to participate for study credit, a penalty (loss of one study point) would apply, whereas no penalties could be imposed on wider community members. Another issue that arose during this phase was some technological problems with the use of the Instant Survey app. When those happened, participants were sent SMS surveys instead, which did not seem to impact how participants felt, although it did add some time to the researchers' responsibilities.

Implementation of follow-up. As all participants started at different times in the semester, the follow-up measures after six weeks were all at different times as well. Some participants had the follow-up measures coincide with a non-average semester week. This may have led to the consumption of takeaway drinks being different from an average week on campus. The extent to how many people were affected is difficult to evaluate, as only a few participants reported on this happening.

Discussion

The aim of this study was to evaluate the acceptability of the intervention and form recommendations for future behaviour change interventions in this area. The

quantitative survey demonstrated general acceptability of the intervention among participants, with no difference between the intervention groups, except the evaluation of relevance and length of the intervention. The environmental values group was unanimous in agreeing with the relevance of the intervention. Evoking environmental values with novel, memorable content proved effective and led to higher levels of habit strength and higher maintenance of behaviour in the long-term. The content may have activated environmental emotions, which are known to mediate the relationship between knowledge and pro-environmental behaviour (Carmi et al., 2015). The control group also found the intervention significantly longer than the intervention groups. As they did not have any intervention provided except the information that their behaviour would be recorded, the whole process may have appeared less purposeful and thus seem unnecessarily long. The only difference in the evaluation of the content of the interventions between males and females was that males generally evaluated the contents of the intervention as less personally relevant than females. The sample for our study was self-selected and predominantly female, which may indicate a need to focus future efforts on involving more males in similar interventions. Females in general are performing more pro-environmental behaviours, such as recycling, compared to males (Hunter et al., 2004; Olsson & Gericke, 2017). Males and females are also likely to benefit from different mechanisms targeted within interventions (Vicente-Molina et al., 2018), which suggests that males could benefit more from tailored interventions. No practical significance was found for evaluation of intervention by age. Even though evidence suggests that those, who are older, participate in pro-environmental behaviours more (Wiernik et al., 2013), within our sample around 50% of participants were 21 years old or younger, which may be the reason that no variability was detected.

The Instant Survey application, used to measure behaviour, was evaluated positively, with no statistically significant differences for gender and age. However, interviews, open-ended questions and researcher's observations were helpful in identifying areas to improve upon when developing an app-based measure for similar studies.

The qualitative findings also provided useful information about what worked and did not work according to the participants. For the environmental values group, the information presented in the video was new, and memorable, which might have

been the component that worked well for this group, as they demonstrated the highest use of reusable cup and the highest rates of maintenance of behaviour at follow-up (Novoradovskaya et al., 2021). Participants in the intention group reported the usefulness of the goal-setting activity, which is a well-known behaviour change technique for strengthening motivation to engage in a behaviour (Hines et al., 1987; Michie et al., 2013). Participants in the habit group made a choice of a favourite coloured cup, which may have helped them identify with the cup more and make it more pleasant to use (Bartle et al., 2019). However, one interesting comment about the favourite colour of the cup blending in with the environment, which reduced its capacity as a cue to trigger the habit, may reflect a more complicated effect that choice might have on habit formation. The cue that triggers the habit has to be salient (Gardner, 2015), and be distinguishable within the repeated context (the cup as a cue in the stable context of a home). Here an interesting situation is described by a participant, where the cue is not salient enough in the context, however, identification with the cue is strong (black is a favourite colour, however, the furniture where the cup sits, is also black). Providing more information on the choice of the cue may improve the creation of a habit in future interventions.

A common issue that was reflected both in the open-ended survey questions and in the researcher's observations was the timing of the follow-up survey, which often coincided with non-normal weeks for participants. This seems to be one of the most prevalent implementation problems, which may have affected a number of participants. They may have reported a different number of takeaway drinks than they would have consumed on an average week on campus, which could have resulted in inaccurate reflection of usual consumption. This problem could be resolved by either extending the measurement period beyond one week, or controlling for semester breaks when recruiting participants (recruit them at a certain week of semester, not closer to the end of semester). Having a continuous measure would also assist in recording consumption of those who have takeaway drinks less regularly.

Participants in all the groups reported that the Instant Survey app was not only simple to use, it also served as an intervention component of self-monitoring by recording the number of times the reusable cup was used, but also as a reminder to use it when the notifications appeared on the screen. Considering the majority of the intervention was carried out online, and the face-to-face component was time

consuming, in order to be able to scale up the intervention, moving the intervention fully online may be a solution, where pre-recorded content does not require the researcher's presence. This would save contact hours, costs, increase the scalability of the intervention, and may result in faster recruitment rates due to accessibility (Cugelman et al., 2011).

We did not recruit a sufficient number of participants from all three intervention groups for exit interviews, therefore the conclusions drawn from the qualitative strand of this study should be evaluated with caution. The participants in the environmental values group outnumbered representatives of other groups in the interviews. This intervention group demonstrated the highest adoption of behaviour of using a reusable cup and the highest maintenance rate after a six-week follow-up; hence, the mere desire to share their opinions with the research team may be an indication that this particular intervention was more memorable than the other intervention conditions, or more engaging for the participants. It was supported by the fact that participants in the environmental values group reported the video to have novel information, as well as being somewhat 'shocking' and memorable.

Lessons Learned

We have learned several important lessons from conducting a behaviour change intervention aimed at promoting the use of a reusable hot drink cup. Providing participants with memorable content along with an alternative proved to be effective, and can potentially be used for other pro-environmental behaviours, such as using reusable bags when shopping or reusable cutlery when purchasing takeaway foods, and other sustainable alternatives, such as choosing to take a bicycle instead of driving. Self-monitoring can assist in behaviour change and maintenance, and is quite simple to implement with the use of phone apps or text messages. Moving intervention fully online can save costs and provide a wider participation. Tailoring content for male participants can be important, as in the current intervention they found the intervention less relevant than females.

Conclusions

The intervention to increase the use of reusable hot drink cups was effective and well received among participants. For future research in the area of promoting pro-environmental behaviours, we recommend focusing on memorable educational content able to evoke values toward the environment along with provision of free

reusable alternatives. Further, we recommend adding a component of self-monitoring. The intervention may benefit from moving to full online implementation, which would reduce the cost of the intervention. Tailoring of content towards male participants is also recommended.

The principles used in this intervention can be applied to other pro-environmental behaviours and potentially to other closed settings, such as office buildings or communities. Future efforts should investigate it further in order to reduce the amount of waste that is being discarded every day.

Chapter 6. General Discussion

The aim of the current chapter is to revisit the overall aims of the thesis, summarise the main findings, and discuss the implications of the results for research and practice. General limitations of the thesis are addressed and future research recommendations are made. The chapter ends with general conclusions for the entire body of work.

Summary of the Aims

The overarching purpose of the project was to understand the important predictors of a pro-environmental behaviour of using a reusable cup and apply them to implement effective behaviour change. The first aim of this research project was to understand the psychological factors underlying a pro-environmental behaviour of using a reusable cup, which was implemented within phase one of this project (Chapter 2 and 3). The aim of developing and evaluating an effective behaviour change intervention based on those factors was reflected in phase two of the project (Chapters 4 and 5). An additional aim was to explore how the concept of habit can be helpful in changing a pro-environmental behaviour, which was reflected upon throughout the entire project. A combination of qualitative and quantitative methodologies was used to investigate the abovementioned goals.

Key Findings

Predictors of Behaviour of Using a Reusable Cup

Several factors that underlie the pro-environmental behaviour of using a reusable cup were identified in the process of achieving the first aim of the project. Intention and values towards the environment were found to be important predictors of the target behaviour, with factors such as habit strength, conscientiousness, need for structure, and intolerance of uncertainty not related to use of reusable cup in multivariate analysis (Chapter 2). Based on the results of two studies of this project (Chapters 2 and 4), it seems that individuals who are less comfortable with uncertainty and have a stronger habit of using a reusable cup tend to use the cup more. Yet, as seen in Chapter 2, intention to use a reusable cup may strengthen the formation of habit. This may be particularly important for a behaviour such as using a reusable cup, which is not inherently rewarding. Commensurate with this, an individual's values towards the environment appear particularly salient in determining whether

someone uses their reusable cup or not, suggesting the necessity of both automatic (habit) and motivational (intention and values) processes in implementing this behaviour in the absence of tangible rewards. Values play a role as a motivator, resulting in feeling good about oneself when acting according to one's values; in this way, evoking of values may reinforce use of the cup. Thus, extra motivation may be needed for performance of pro-environmental behaviours to support their regular implementation, which may be enacted within the values towards the environment.

The way certain trait-like dispositions and personality traits may play a role in the behaviour of using a reusable hot drink cup was explored. Although previous research has suggested a relationship between trait conscientiousness and a related construct of need for structure, and habitual behaviours, this was not observed in current research (Chapter 2). It is possible that in multivariate analysis this relationship did not emerge due to shared variance, thus this can potentially be explored further as individual factors possibly contributing to the behaviour of using a reusable cup. However, a significant interaction between intolerance of uncertainty, habit strength and use of reusable cups was demonstrated, where those with high level of intolerance of uncertainty and high habit strength tend to use a reusable cup more (Chapters 2 and 4). This is a new finding that can shed light on the development of interventions in the area of pro-environmental behaviours. The implication here is of importance to pro-environmental behaviours, as the current climate change context can produce a lot of worry about the future of the planet and sense of lack of control when it comes to dealing with those consequences (Cunsolo & Ellis, 2018; Majeed & Lee, 2017). People who exhibit worry about the future of the planet and climate change together with high biospheric values tend to perform various climate actions more than those who do not (e.g., supporting climate policies and performing energy saving behaviours; Bouman et al., 2020). As intolerance of uncertainty, especially the aspect of desire for predictability, is strongly connected with worry, those who do not tolerate uncertainty could benefit from the introduction of measures that can increase predictability of the future by adding structure to everyday life (Bredemeier & Berenbaum, 2008). The worry about the future of the planet thus can potentially be mitigated by increasing predictability, for instance, by using a reusable cup everyday people can be certain that they produce no waste and thus do not contribute to the otherwise increasing reason to worry (onset of negative consequences for the planet).

The relationship between intolerance of uncertainty, habit strength and pro-environmental behaviour can be further investigated in other behaviours. An interesting future research avenue may also lie in testing whether pro-environmental habitual behaviours can reduce worry about the future of the planet.

The qualitative exploration of how habit is perceived by the expert community and those who are the target audience of the intervention helped shed light on how to best emphasise the important aspects of habit within the intervention (Chapter 3). The importance of cues was outlined by both groups alike as a key component of habit. The significance of cues was reflected upon within the intervention (Chapter 4) by providing information about the importance of cues and a description of what a cue is, a choice of colour of the cup to participants, and instructions on how to create a salient cue. Lay people's conceptualisation of habit involved behaviours occurring regularly, even every day, whereas more rarely occurring behaviours were not mentioned as being habitual. Using a reusable cup may not necessarily be a frequent behaviour unless one has takeaway drinks every day. For those who work from home or an office where they can keep a ceramic mug, those who do not drink coffee every day or do not visit campus regularly, this behaviour may be rare in frequency, which may imply it is less habitual. The possibility of behaviours that occur less frequently, for example, blood donations, becoming habitual was mentioned among the experts in the interviews and within previous literature (Ouellette & Wood, 1998). This was emphasised when communicating with the participants in the habit condition within the intervention by highlighting the importance of cue independent of frequency of consumption of takeaway hot drinks.

Both studies within phase one of the research (Chapters 2 and 3) helped inform the treatment conditions within the intervention program, that aimed to increase use of reusable cups among students of an Australian university. The design of the two intervention conditions where values towards the environment as well as intention were targeted, stemmed directly from the findings of the predictive study (Chapter 2), as those two constructs were the only strong psychological predictors of reusable cup use. Habit, as a promising concept within the behaviour change literature, is at a focal point of this research project. Habit was explored in a qualitative manner to get more insight into how a habit-based condition of the intervention can produce the most effective results. Interviews with experts and students within the university

helped shape the delivery of the habit-based treatment condition and the emphasis on cues within it, at the same time adding in-depth information about how habit as a concept is understood within those two groups (Chapter 3).

Targeting the Predictors of Reusable Cup Use for Behaviour Change

The aim of the intervention phase was to test the ability of three intervention conditions to increase the use of reusable cups among university students (Chapter 4). It was found that all three intervention groups increased their use of reusable cups, which indicates that the mere presence of an intervention, monitoring (behaviour measure), or provision of a free reusable cup produces a behaviour change. More importantly, those who underwent an intervention changed their behaviour with the help of establishing strong habits. This shapes a different view on how the concept of habit can play a role within pro-environmental behaviour change. The findings indicate that in order for a habit to form, it is not necessary to target habit within the intervention, but rather the behaviour needs to be performed over and over, which assists in the process of strengthening habit. Even participants in the control condition slightly increased their use of reusable cups by the end of the six-week intervention, which may indicate that the aspect of monitoring one's behaviour and simply being aware of the fact that the program is about using reusable cups can produce change. The group that not only increased their use of a reusable cup but maintained this level at follow-up was the Environmental Values group. As such, providing participants with information about the consequences of an undesired behaviour (using a paper cup) and a solution to the problem (giving them a reusable cup) seemed to have produced the highest adherence to the behaviour long-term. Consistent with prior work, it was found that to change a pro-environmental behaviour long-term, information is vital when it comes to advising participants about the consequences of behaviour (Abrahamse & De Groot, 2013; Steg & Vlek, 2009). However, fear appeals are not as effective when provided without a solution to the problem; a sense of being able to contribute to fixing the issue may play a significant role in changing from a non-sustainable alternative to a sustainable one (Peters et al., 2018). Participants in the Intention and Habit groups demonstrated an initial increase in behaviour, however, the use of reusable cups at follow-up declined. This may be an indication that the content of the Habit and Intention interventions were not as effective in maintenance of behaviour as was addressing the construct of environmental values. The nature of

pro-environmental behaviours is such that many people may not be aware of the actual consequences that certain behaviour can have on the environment. This is in contrast to some health behaviours, where the knowledge about negative effects is common (e.g., smoking or unhealthy diet). Hence, providing information about the actual consequences of a behaviour (i.e., paper cups are not being recycled and end up in landfill) is important to understand why the behaviour needs to change and develop motivation to maintain the change.

The intervention demonstrated effectiveness in changing behaviour, and was also evaluated on its acceptability among the recipients using a mixed methods approach. The intervention was well received by all participants and the only difference found was between how females and males perceived the relevance of the intervention, with males perceiving it as slightly less personally relevant; future interventions may need to be tailored for men. The sample of the study was predominantly female, moreover, generally males are less likely to participate in pro-environmental actions (Hunter et al., 2004; Olsson & Gericke, 2017), which is indicative of more efforts needed to recruit male participants for future interventions and to develop tailored interventions for males. Qualitative findings and researcher reflections indicated that the intervention was well received, however could be improved by moving online and conducting baseline and follow-up measures within the same stable context.

Research Implications

The work undertaken in this thesis can serve as a basis for developing and expanding further research in several important areas. The relationship between intention and habit has been explored previously, but the results seem to vary depending on the behaviour (Mullan & Novoradovskaya, 2018). For the particular behaviour of using a reusable cup, intention seems to play a more significant role in predicting engagement in the behaviour compared to habit strength, as was shown in Chapter 2. Habit did not explain any significant variance in behaviour, however demonstrated a significant bivariate relationship with intention, meaning that possibly for this type of behaviour both are important. The intervention (Chapter 4) also demonstrated that the participants of the treatment condition that was targeting habit formation did not maintain the behaviour change over time, which together with the results of predictive study (Chapter 2) may indicate the need of extra motivation

to be present to be engaging in the behaviour on a regular basis. This offers an interesting implication for pro-environmental behaviour change, where exploring and targeting motivational components (associated with intrinsic motivation of acting in accordance with one's values) would be of interest. At the same time, habit may serve as a potential mechanism underlying behaviour change, as demonstrated in Chapter 4, suggesting that habit strength can be increased through targeting various constructs in the process of behaviour change, including intention and activation of values. This may be an indication that interventions based on principles of habit formation may not be the best to produce the desired effect within such behaviours, but habit may be formed when targeting motivational constructs and through repetition.

Another research implication comes from the exploration of personality traits and their interaction with habit in the context of pro-environmental behaviours. Habit has previously been associated with traits such as conscientiousness (Milfont & Sibley, 2012; Swami et al., 2011) and self-control (Carden & Wood, 2018; Gillebaart & Adriaanse, 2017), however, it may also be associated with other personality aspects. Those who demonstrate a stronger habit of using a reusable cup and are also less tolerant of uncertainty, use their reusable cups more (Chapters 2 and 4). This may indicate that habit is not a universal construct that can be effectively applied to the entire population but is dependent on individual differences. This opens a discussion about the usefulness of principles of habit for specific populations, where it can become a coping mechanism, through introducing a structure to one's everyday life and thus assisting in dealing with the negative feelings in the face of uncertainty. This relationship can also help the understanding of incorporating more positive, healthy and environmentally friendly habits in everyday life, as well as why some may benefit from incorporating habits in their life more, and some less. Potentially, introducing habitual pro-environmental behaviours in everyday life can assist in mitigating worry about the future of the planet, which can arise due to the issue of plastic pollution being on the rise globally, while simultaneously reducing the amount of waste in landfills.

An important research implication can be derived from the qualitative exploration of the concept of habit that was carried out in phase one of this research (Chapter 3). Habit as a scientific concept has been largely discussed within the field and on the interdisciplinary arena (e.g., Fleetwood, 2019; Gardner, 2015) with

researchers exchanging views on what constitutes definition of habit (e.g., a conversation between Gardner et al., 2019; Hagger, 2019; Phillips, 2020). Habit was examined from the standpoint of the scientific definition within the field of habit psychology, through conversations with experts, and the very recipients of habit-based behaviour change interventions. This has not been done in this area before (lay representations alone were explored in unpublished work by Brown et al., 2019), however lay representations and consumer engagement are widely used in health research (Kidd et al., 2007; Walsh et al., 2016). This study helped shed light on some of the similarities and differences that lay people and experts have when it comes to talking about what habit is. For example, the importance of cues, automaticity, and rewards for habit formation were outlined by both groups. Yet lay people were more likely to describe habit as a behaviour, something that they do, which provides them very little space to break habits, as behaviour is notoriously hard to change. Lay people were also more likely than experts to refer to habit as a stable disposition of 'being a habitual person', which implies that if they are not a habitual person, they cannot benefit from having habits in their lives. If this is indeed the case these discrepancies are important to address, as they may have an impact on how effective habit interventions can be (Ward et al., 2010). This investigation helped build on the importance of addressing habit within behaviour change interventions and the way habit can be communicated to the recipients of interventions, emphasising its potential for change and introducing effective strategies to do so. Moreover, an important implication stems from a discussion point of a potential need for new terminology with regard to habit within scientific community, as the current term 'habit' has a well-established meaning within the lay community and popular literature, which is at odds with the experts' definition. Introducing a new, more nuanced scientific term for habit may lead to better communication between researchers and intervention consumers.

Throughout the current research two different methods of collecting behavioural data were utilised: the timeline follow-back self-report measure (Sobell & Sobell, 1992) and a phone app used for ecological momentary assessment (EMA) studies "Instant Survey" (Richardson, 2015a, 2015b). Using EMA tools for reporting behaviours such as using a reusable cup has advantages over retrospective self-report that asks one to indicate the frequency of behaviour over the past week or longer.

Recalling behaviour twice a day and entering the value into the app allows for better capture of behaviour than trying to recollect instances of cup use over the last week. This opens up opportunities to use EMA tools for capturing behaviours more consistently, reducing recall bias. Apps designed for this purpose are easily adaptable and affordable to use, which makes it accessible and valid for use in future research.

Practical Implications

The current work provides important practical implications for research translation, as well as for policy development, and businesses and individuals wishing to focus on pro-environmental behaviour change. For those wishing to encourage the uptake of behaviours like using a reusable cup, it is important to deliver memorable information on the consequences of actions together with offering a solution for the problem. Use of these strategies was associated with an immediate uptake of behaviour as well as the strongest maintenance of it long-term. Educating individuals and organisations on the impacts of everyday behaviours on the environment is of great importance, and it empowers individuals to change those behaviours. It is also essential to improve science communication efforts and intervention delivery in order to reach the populations that may benefit from these interventions the most. As shown in Chapter 5, efforts can be directed to recruitment of male participants and tailoring interventions for them, as they are a population that is less involved in pro-environmental behaviours (Hunter et al., 2004; Olsson & Gericke, 2017). Moreover, individuals with high intolerance of uncertainty would benefit from forming habits much more than those who are more comfortable with uncertainty (Chapters 2 and 4). Hence, developing a range of interventions based on different change mechanisms would potentially benefit these populations more than delivering the same content to everyone.

One of the largest manufacturers of reusable cups in Australia and in the world, KeepCup™, generously donated reusable cups for the intervention study. A list of recommendations was prepared for KeepCup™ to foster behaviour change in individuals and organisations. This list expands beyond one individual organisation to other businesses, such as cafes, universities, and large business offices among others. The recommendations included provision of knowledge regarding the consequences of using paper cups paired with offering solutions – reusable cups. For example, putting a poster with information on how paper cups are ending up in the

ocean together with reusable cups on sale may be useful within café environments. Fostering principles of habit formation is also important, for instance, through incorporating rewards for using your own drink container – simple loyalty cards that provide a free 10th drink when you bring your own cup nine times before that; or creating cues by providing personalisation of cups or colourful stickers that can be put on the mirror, phone or car dashboard to ease the salience of cue to take your cup with you. Changes in contextual factors are also important, such as providing cup deposit schemes, where there is no need for paper cups to be on sale. Closed environments, such as universities and office buildings should consider distributing free or discounted cups to students and staff in order to encourage waste reduction. In combination with previous research on substituting discounts for charging extra for using single-use cups (Poortinga & Whitaker, 2018), findings from this project can help reduce waste by fostering individual and organisational behaviour change.

Limitations and Future Directions

Strengths and Limitations

This research has a number of strength that distinguishes it from similar work. A mixed methods approach was used, which provides more depth and understanding into the findings. A behaviour change intervention for a specific pro-environmental behaviour was conducted, which was explored in a limited manner previously, but provides a template of how to work with other similar behaviours. The intervention was evaluated in order to understand what can be done differently in the future to increase effectiveness of the interventions of this scale.

A number of limitations of this work include methodological, theoretical and sampling issues that need to be addressed in the future. Firstly, only a number of factors that may be important in predicting pro-environmental behaviours were investigated that were previously underexplored (such as habit and intolerance of uncertainty). Taking into consideration the complexity of pro-environmental behaviours, a much wider array of mechanisms are likely at play. Within the field of environmental psychology a number of important predictors of pro-environmental behaviours have been identified that do include values and intention (Abrahamse & De Groot, 2013; Bamberg & Möser, 2007), but also consider attitudes, norms and other variables (Bamberg & Möser, 2007; Bamberg & Schulte, 2018), therefore a combination of predictors, both established and underexplored, should be studied.

Moreover, when talking about mechanisms of behaviour change (see Chapter 4), it is important to understand, that even though habit strength was demonstrated to be an important factor in producing increase in use of reusable cups, it certainly is not the only one. Further studies may want to test other potential mechanisms that may be at play, including simple provision of a reusable cup. Another limitation may be cue proposed for the Habit condition of the intervention study. The cue was directed at remembering to bring the cup with you, whereas the behaviour measure and the self-report habit index were assessing the use of reusable cup when buying a takeaway drink. It is possible to remember to bring the cup with you and still forget to use it while buying a coffee. This may have produced the result of Habit condition of the intervention being less effective than the other two conditions. Future research may separate the preparatory stage (remembering to bring the cup with you) and the actual use of reusable cup in the café.

In this research, the effects of minimum intervention – and what minimum intervention would constitute – was not established. Indeed, the provision of a reusable alternative may be sufficient to develop a habitual behaviour of using it without any psychological intervention, as the behaviour simply cannot be performed without owning a reusable cup (with the exception of opting out to drink from the café's own cup rather than having a paper cup to go). Future research could test provision of a reusable cup on its own to be able to determine if it is as effective without a psychological intervention. It would allow for provision of minimal interventions to wider populations to produce effective results while being cost-effective. Having three different intervention conditions was a strength of the intervention study, as it allowed examination of the relative efficacy of specific components, however, this may also be a limitation, as the most effective intervention may be a combination of the three, which could yield superior effects: increased motivation with the activation of environmental values component combined with increased intention, and principles of habit formation.

Future Directions

A specific pro-environmental behaviour of using a reusable cup, its predictors and possibilities for change were investigated. Important predictors and mechanisms likely to underlie behaviour change within this behaviour were found. Habit-based interventions have been deemed effective with some other pro-environmental

behaviours (Holland et al., 2006; Verplanken & Roy, 2016), however, investigating whether this particular intervention design can be applicable to other sustainable behaviour would be useful. It can provide understanding into how the behaviours function and ways to change them effectively, and whether or not different behaviours under the same umbrella can be targeted through similar principles.

The majority of participants in all four studies within this research were students within Australian universities. This population was chosen as university environments are suitable for implementation of interventions such as this one (Chapter 4) due to the closed nature of the environment (Poortinga & Whitaker, 2018), and younger people participate in pro-environmental behaviours to a lesser extent than older generations (Gilg et al., 2005). However, it is important to understand whether interventions such as this may be applicable to other populations outside a university environment. Some other research has focused on, for example, office buildings (Poortinga & Whitaker, 2018), which are also closed environments. Hence, expanding the intervention application beyond a university, or even beyond closed environments (e.g., to small businesses or even entire cities) is an interesting future direction. The same applies to the study of lay representations of habit: it may differ in a population beyond university students and with regard to specific behaviours. Investigating those may assist in furthering efforts of communicating and translating science to specific audiences and intervention recipients.

Conducting behaviour change interventions is a challenging task that is often undertaken by research teams and requires extensive funding. When conducting interventions with limited resources, such as within a doctoral degree research, it is important to discuss scalability of undertaken interventions. Evaluation of the intervention to increase the use of reusable hot drink cups (Chapter 5) helped to understand ways to make the intervention more scalable, cost-effective and easily accessible. Future research should consider moving similar interventions online in order to increase accessibility, decrease costs and face-to-face hours. As this intervention had a very brief face-to-face component, it can be easily translated to an online resource, however, the effectiveness of an online intervention would still need to be established.

Conclusions

The current research provides evidence for the effectiveness of interventions aimed at establishing pro-environmental habits. The use of a mixed methods approach towards establishing potential predictors and clarifying the process of intervention delivery assisted in the development of an effective intervention, its implementation, and evaluation. This body of work may assist in the future development of similar interventions for pro-environmental behaviours, aimed at forming stronger habits, and further efforts into establishing the link between individual differences and habit. Moreover, a contribution to the exploration of potential theoretical developments within the area of habit psychology was made, further establishing habits as important factor in changing and maintaining good behaviours.

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Appendices

Appendix 1

Ethics approval letter for studies 1 and 2 (Chapter 2 and 3)

Curtin University

Office of Research and Development

GPO Box U1987
Perth Western Australia 6845

Telephone +61 8 9266 7863
Facsimile +61 8 9266 3793
Web research.curtin.edu.au

30-Mar-2017

Name: Barbara Mullan
Department/School: School of Psychology and Speech Pathology
Email: Barbara.Mullan@curtin.edu.au

Dear Barbara Mullan

RE: Ethics approval
Approval number: HRE2017-0173

Thank you for submitting your application to the Human Research Ethics Office for the project **Predicting habitual behavior**.

Your application was reviewed through the Curtin University low risk ethics review process.

The review outcome is: **Approved**.

Your proposal meets the requirements described in National Health and Medical Research Council's (NHMRC) *National Statement on Ethical Conduct in Human Research (2007)*.

Approval is granted for a period of one year from **30-Mar-2017** to **29-Mar-2018**. Continuation of approval will be granted on an annual basis following submission of an annual report.

Personnel authorised to work on this project:

Name	Role
Mullan, Barbara	CI
Novoradovskaya, Elizaveta	Co-Inv

Standard conditions of approval

1. Research must be conducted according to the approved proposal
2. Report in a timely manner anything that might warrant review of ethical approval of the project including:
   - proposed changes to the approved proposal or conduct of the study
   - unanticipated problems that might affect continued ethical acceptability of the project
   - major deviations from the approved proposal and/or regulatory guidelines
   - serious adverse events
3. Amendments to the proposal must be approved by the Human Research Ethics Office before they are implemented (except where an

amendment is undertaken to eliminate an immediate risk to participants)

4. An annual progress report must be submitted to the Human Research Ethics Office on or before the anniversary of approval and a completion report submitted on completion of the project
5. Personnel working on this project must be adequately qualified by education, training and experience for their role, or supervised
6. Personnel must disclose any actual or potential conflicts of interest, including any financial or other interest or affiliation, that bears on this project
7. Changes to personnel working on this project must be reported to the Human Research Ethics Office
8. Data and primary materials must be retained and stored in accordance with the Western Australian University Sector Disposal Authority (WAUSDA) and the Curtin University Research Data and Primary Materials policy
9. Where practicable, results of the research should be made available to the research participants in a timely and clear manner
10. Unless prohibited by contractual obligations, results of the research should be disseminated in a manner that will allow public scrutiny; the Human Research Ethics Office must be informed of any constraints on publication
11. Ethics approval is dependent upon ongoing compliance of the research with the Australian Code for the Responsible Conduct of Research, the National Statement on Ethical Conduct in Human Research, applicable legal requirements, and with Curtin University policies, procedures and governance requirements
12. The Human Research Ethics Office may conduct audits on a portion of approved projects.

Special Conditions of Approval

None.

This letter constitutes ethical approval only. This project may not proceed until you have met all of the Curtin University research governance requirements.

Should you have any queries regarding consideration of your project, please contact the Ethics Support Officer for your faculty or the Ethics Office at hrec@curtin.edu.au or on 9266 2784.

Yours sincerely

Dr Catherine Gangell
Manager, Research Integrity

Appendix 2

Example of participant information sheet, consent form and questionnaires for Study 1 (Chapter 2)

Baseline questionnaire Study 1

Participant Information Sheet

Title of Project: Formation of habitual behaviour

You are being invited to take part in a research study. Before you decide whether or not to take part, it is important for you to understand why the research is being conducted and what it will involve. Please take the time to read the following information carefully and decide if you want to take part in this study. Please feel free to ask if there is anything that is not clear or if you would like more information.   The study investigates how habits are formed. The study involves completing questionnaires at two time points measuring your engagement in an environmental behaviour, your demographics and some personality characteristics. The second assessment will take place 1 week after the first. Both questionnaires will be completed online and usually takes around 15 minutes in total. After completion of the second survey you will have a chance to enter a Coles gift voucher raffle.

Do I have to take part? Participation in this study is totally voluntary; you are under no obligation to take part in this study. The data that you provide will be very useful for our study. Your consent to participate will be asked before completing the questionnaires. You have the right to withdraw from the study prior to submitting your responses without penalty.

What happens to the information I provide?   The information you provide will be kept confidential. Only the research team will have access to the information you provide. Data will be stored for a minimum of seven years in accordance with Western Australian University Sector Disposal Authority's (WAUSDA) data storage policy. Once the data is analysed a report of the findings may be submitted for publication. Only broad trends will be reported and it will not be possible to identify

any individuals. A summary of the results will be available from the researcher on request once the study is complete.

If you have any questions or require any further information, please contact the researcher

Name of principal investigator: A/Prof Barbara Mullan

E-mail: *barbara.mullan@curtin.edu.au*

Telephone: 9266 2468

Co-investigator: Elizaveta Novoradovskaya

E-mail: *elizaveta.novoradovskaya@postgrad.curtin.edu.au*

Thank you for taking the time to read this Participant Information Form and considering taking part in the study.   We hope that you feel able to help us with this study.   *Curtin University Human Research Ethics Committee (HREC) has approved this study (HRE2017-0173). Should you wish to discuss the study with someone not directly involved, in particular, any matters concerning the conduct of the study or your rights as a participant, or you wish to make a confidential complaint, you may contact the Ethics Officer on (08) 9266 9223 or the Manager, Research Integrity on (08) 9266 7093 or email hrec@curtin.edu.au.*

To indicate that you agree with the statements below, please choose 'YES' in the box below.

I confirm that I have read and understood the information sheet provided above.

I have had opportunities to ask questions and my questions have fully been answered.

I understand that my participation is voluntary and that I am free to withdraw at anytime, without giving any reason.

I have received enough information about the study. I hereby provide my consent to participate in the study.

○   Yes

○   No

Please write your contact e-mail so that we can send you the second survey. Your contact e-mail will not be used in identification purposes.

_____

Please indicate your student/staff ID below for us to be able to match your first response with your second one. This will not be used to identify your name with your answers.

_____

Please indicate your gender.

○   Male   (1)

○   Female   (2)

○   Other Gender   (3)

How old are you (in years)?

_____

Please enter your predominant ethnicity.

○   Australian (1)

○   Asian (2)

○   Aboriginal or Torres Strait Islanders (3)

○   European (4)

○   African (6)

○   Other (please specify) (5)

_____

Please select your highest level of education.

○   Primary school (1)

○   High school or equivalent (2)

○   Undergraduate degree or TAFE Certificate (3)

○   Post-graduate degree (4)

○   Other (please, specify) (9)

_____

Please select your current living situation.

○   With parents (1)

○   With friends / flatmates (2)

○   With partner (3)

○   College (4)

○   Alone (5)

○   Other (please, specify) (6)

_____

What is your current relationship status? Choose all that apply.

☐   Divorced (1)

☐   Living with another (2)

☐   Married (3)

☐   Separated (4)

☐   Single (5)

☐   Widowed (6)

☐   In a relationship (living separately) (7)

☐   Other (8)

_____

☐   Prefer not to say (9)

End of Block: Demographic Information

Have you ever used a reusable drink cup before? By reusable drink cup we mean any sort of cup, used for takeaway drinks that you buy in cafes. They can be made out of plastic, glass or other durable materials, that allow to use the cup more than once, as opposed to a single-use paper/plastic cups that you throw away after finishing your drink. Reusable cups can be used for coffee, tea, hot chocolate, or cold beverages, such as smoothies, juices, iced coffee or tea, milkshakes or others. For example, a reusable cup can be a KeepCup^{TM}, or any other branded reusable cup.

○   Yes (1)

○   No (2)

If No is answered. What is the main reason you are not using a reusable cup? Please write your response below.

_____

If Yes is answered. What is the main reason you are using a reusable cup? Please write your response below.

_____

If you answered yes to the previous question, how often have you used a reusable drink cup in the past three months?

○   Once or more a day (1)

○   A few times a week (2)

○   Once a week (3)

○   Less than once a week (4)

○   Never (5)

End of Block: Past behaviour

Start of Block: Habit Information

If you have used a reusable drink cup before, please answer the following questions. Using a reusable drink cup is something...

	Strongly Disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
I do frequently. (1)	○	○	○	○	○	○	○
I do automatically. (2)	○	○	○	○	○	○	○
I do without having to consciously remember. (3)	○	○	○	○	○	○	○
That makes me feel weird if I do not do it. (4)	○	○	○	○	○	○	○
I do without thinking. (5)	○	○	○	○	○	○	○
Would require effort not to do it. (6)	○	○	○	○	○	○	○
That belongs to my daily routine. (7)	○	○	○	○	○	○	○
I start doing before I realise I'm doing it. (8)	○	○	○	○	○	○	○
I would find hard not to do. (9)	○	○	○	○	○	○	○
I have no need to think about doing. (10)	○	○	○	○	○	○	○

That's typically 'me'. (11)	○	○	○	○	○	○	○
I have been doing for a long time. (12)	○	○	○	○	○	○	○

End of Block: Habit Information

Start of Block: Intention

Please indicate how much you agree or disagree with the following statements.

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
I intend to use a reusable cup every day over the next week. (1)	○	○	○	○	○	○	○
I plan to use a reusable cup every day over the next week. (2)	○	○	○	○	○	○	○

End of Block: Intention

Start of Block: Intolerance for uncertainty

Please choose a statement that best corresponds to how much you agree with each item.

	Not at all characteristic of me (1)	A little characteristic of me (2)	Somewhat characteristic of me (3)	Very characteristic of me (4)	Entirely characteristic of me (5)
1. Unforeseen events upset me greatly. (1)	○	○	○	○	○
2. It frustrates me not having all the information I need. (2)	○	○	○	○	○
3. Uncertainty keeps me from living a full life. (3)	○	○	○	○	○
4. One should always look ahead so as to avoid surprises. (4)	○	○	○	○	○
5. A small unforeseen event can spoil everything, even with the best of planning. (5)	○	○	○	○	○
6. When it's time to act, uncertainty paralyses me. (6)	○	○	○	○	○
7. When I am uncertain I can't function very well. (7)	○	○	○	○	○
8. I always want to know what the future has in store for me. (8)	○	○	○	○	○
9. I can't stand being taken by surprise. (9)	○	○	○	○	○
10. The smallest doubt can stop me from acting. (10)	○	○	○	○	○

11. I should be able to organize everything in advance. (11)	○	○	○	○	○
12. I must get away from all uncertain situations. (12)	○	○	○	○	○

End of Block: Intolerance for uncertainty

Start of Block: Need for Structure

Read each of the following statements and decide how much you agree with each according to your attitudes, beliefs, and experiences. It is important for you to realize that there are no "right" or "wrong" answers to these questions. People are different, and we are interested in how you feel. Please respond according to the following 6-point scale:

	Strongly disagree (1)	Moderately disagree (2)	Slightly disagree (3)	Slightly agree (4)	Moderately agree (5)	Strongly agree (6)
1. It upsets me to go into a situation without knowing what I can expect from it. (1)	○	○	○	○	○	○
2. I'm not bothered by things that interrupt my daily routine. (2)	○	○	○	○	○	○
3. I enjoy having a clear and structured mode of life. (3)	○	○	○	○	○	○
4. I like to have a place for everything and everything in its place. (4)	○	○	○	○	○	○
5. I enjoy being spontaneous. (5)	○	○	○	○	○	○
6. I find that a well-ordered life with regular hours makes my life tedious. (6)	○	○	○	○	○	○
7. I don't like situations that are uncertain. (7)	○	○	○	○	○	○
8. I hate changing my plans at the last minute. (8)	○	○	○	○	○	○
9. I hate being with people who are unpredictable. (9)	○	○	○	○	○	○
10. I find that a consistent routine enables me to enjoy life more. (10)	○	○	○	○	○	○
11. I enjoy the exhilaration of being in unpredictable situations. (11)	○	○	○	○	○	○
12. I become uncomfortable when the rules in a situation are not clear. (12)	○	○	○	○	○	○

Here are a number of characteristics that may or may not apply to you. Please rate how each statement describes you. I...

	Very Inaccurate (1)	Moderately Inaccurate (2)	Neither Inaccurate nor Accurate (3)	Moderately Accurate (4)	Very Accurate (5)
Am always prepared. (1)	○	○	○	○	○
Pay attention to details. (2)	○	○	○	○	○
Get chores done right away. (3)	○	○	○	○	○
Like order. (4)	○	○	○	○	○
Follow a schedule. (5)	○	○	○	○	○
Am exacting in my work. (6)	○	○	○	○	○
Leave my belongings around. (7)	○	○	○	○	○
Make a mess of things. (8)	○	○	○	○	○
Often forget to put things back in their proper place. (9)	○	○	○	○	○
Shirk my duties. (10)	○	○	○	○	○

Evaluate the following values in respect of how important they are to you from -1 to 7.

	-1 (Opposed to this value) (1)	0 (This value is not important for me) (2)	1 (3)	2 (4)	3 (5)	4 (6)	5 (7)	6 (8)	7 (This value is extremely important to me) (9)
1. Respecting the earth (1)	○	○	○	○	○	○	○	○	○
2. Unity with nature (2)	○	○	○	○	○	○	○	○	○
3. Protecting the environment (3)	○	○	○	○	○	○	○	○	○
4. Preventing pollution (4)	○	○	○	○	○	○	○	○	○

Read each of these statements and express to which extent they apply to you, using the 5-point scale below:

	Strongly disagree (1)	Disagree (2)	Undecided (3)	Agree (4)	Strongly agree (5)
I really worry about things like climate change. (1)	○	○	○	○	○
I feel anxious sometimes about what climate change will do to us. (2)	○	○	○	○	○
It would be easy for me to adjust my lifestyle so that I can live in harmony with nature. (3)	○	○	○	○	○
There are more important things to do than worry about the environment (4)	○	○	○	○	○
I often find myself thinking about the issue of sustainable living and how I can make such changes to my lifestyle. (5)	○	○	○	○	○
I am interested in issues related to the environment and climate change. (6)	○	○	○	○	○
I feel that I can really make a contribution to a better environment. (7)	○	○	○	○	○
I feel happy to raise the topic of sustainable living in conversation when I am with other people. (8)	○	○	○	○	○

Read each of these statements and express to which extent they apply to you, using the 5-point scale below:

	Strongly disagree (1)	Disagree (2)	Undecided (3)	Agree (4)	Strongly agree (5)
Using a reusable cup is something everyone should do (1)	○	○	○	○	○
Because of my values and principles, I feel it is important to try and use the reusable cup (2)	○	○	○	○	○
I feel a moral obligation to use the reusable cup for the sake of the environment (3)	○	○	○	○	○

End of Block: Biospheric values, personal involvement and norms

Follow-up questionnaire Study 1

Participant Information Sheet

Title of Project: Formation of habitual behaviour

Thank you for completing the first survey for our study. Here we ask you to fill in the follow-up for the first survey, which will take you only a few minutes. Questions below will be about an environmental behaviour performance over the last week. You have a chance to enter a raffle of one of four Coles gift vouchers after you fill in the survey. Participation in this study is completely voluntary. You can withdraw anytime you like prior to submitting your answers without penalty.

If you have any questions or require any further information, please contact the researcher

Name of principal investigator: A/Prof Barbara Mullan

E-mail: *barbara.mullan@curtin.edu.au*

Telephone: 9266 2468

Co-investigator: Elizaveta Novoradovskaya

E-mail: *elizaveta.novoradovskaya@postgrad.curtin.edu.au*

Curtin University Human Research Ethics Committee (HREC) has approved this study (HRE2017-0173). Should you wish to discuss the study with someone not directly involved, in particular, any matters concerning the conduct of the study or your rights as a participant, or you wish to make a confidential complaint, you may contact the Ethics Officer on (08) 9266 9223 or the Manager, Research Integrity on (08) 9266 7093 or email hrec@curtin.edu.au.

To indicate that you agree with the statements below, please tick 'YES' in the box below.

I confirm that I have read and understood the information sheet provided above.

I have had opportunities to ask questions and my questions have fully been answered.

I understand that my participation is voluntary and that I am free to withdraw at anytime, without giving any reason.

I have received enough information about the study.

I hereby provide my consent to participate in the study.

○   YES

○   NO

End of Block: Participant Information and Consent

Start of Block: Participant Code

Please indicate your student/staff ID below for us to be able to match your first response with your second one. This will not be used to identify your name with your answers.

_____

End of Block: Participant Code

Start of Block: Timeline Follow-back

The following questions will help you remember what you did last week. It is very important for our research that you remember <u>last week</u> (not an average week) as clearly as possible. There will be separate questions for each of the seven days of the past week. Please, fill in the day (Monday-Sunday) and date. For example, if

today is Monday, 1.05.2017, then Day One for you would be Monday, 24.04.2017; Day 2, Tuesday 25.04.2017, and so on.

In the line Special events, please indicate if this day was any different from your average day that might have affected your hot drink consumption. For example, you fell sick and did not go to school, so that you did not buy any hot drinks that day. Or you had a party the day before, so you had to consume more liquids than usual. If nothing special has happened, you can leave this field blank.

Example:

Day: Monday

Date: 1.05.2017

Special events: classes were cancelled, stayed home

○   **Day 1** (1)

_____

○   Date (2)

_____

○   Special events (3)

_____

- -

The following question will assess how many hot drinks you have had during **Day 1** of your last week. Try to remember as detailed as possible, how many hot drinks you had in the morning, in the afternoon and in the evening. Time is indicated as an example: if you get up and have a cup of coffee at 6 am, then it is still considered morning. For example, if on Day 1 you had a coffee with your breakfast, then a cup of tea in the afternoon and a cup of coffee after lunch, but only water in the evening, then in the first column "Total hot drinks had" you can put 1 in the first line, 2 in the second and 0 in the third. If only the afternoon coffee was had in a reusable cup, then

for the second column you can put a 0 in the first line, 1 in the second line and 0 in the third.

If you cannot remember exactly how many drinks you had and how many times you have used the cup, try to provide an estimation.

	Day 1	
	Total hot drinks had (1)	Hot drinks had in a reusable cup (2)
Morning (07 am - 11 am) (1)		
Afternoon (11 am - 3 pm) (2)		
Evening (3 pm - 10 pm) (3)		

Please indicate day, date and special events for **Day 2**.

○   **Day 2** (1)

_____

○   Date (2)

_____

○   Special events (3)

_____

The following question will assess how many hot drinks you have had during **Day 2** of your last week. Please indicate a number of hot drinks you had during **Day 2**, and how many of them were drank from a reusable cup.

	Day 2	
	Total hot drinks had (1)	Hot drinks had in a reusable cup (2)
Morning (07 am - 11 am) (1)		
Afternoon (11 am - 3 pm) (2)		
Evening (3 pm - 10 pm) (3)		

Please indicate day, date and special events for **Day 3**.

○   **Day 3** (1)

_____

○   Date (2)

_____

○   Special events (3)

_____

- -

The following question will assess how many hot drinks you have had during **Day 3** of your last week. Please indicate a number of hot drinks you had during **Day 3**, and how many of them were drank from a reusable cup.

	Day 3	
	Total hot drinks had (1)	Hot drinks had in a reusable cup (2)
Morning (07 am - 11 am) (1)		
Afternoon (11 am - 3 pm) (2)		
Evening (3 pm - 10 pm) (3)		

Please indicate day, date and special events for **Day 4.**

○   **Day 4** (1)

_____

○   Date (2)

_____

○   Special events (3)

_____

The following question will assess how many hot drinks you have had during **Day 4** of your last week. Please indicate a number of hot drinks you had during **Day 4**, and how many of them were drank from a reusable cup.

	Day 4	
	Total hot drinks had (1)	Hot drinks had in a reusable cup (2)
Morning (07 am - 11 am) (1)		
Afternoon (11 am - 3 pm) (2)		
Evening (3 pm - 10 pm) (3)		

Please indicate day, date and special events for **Day 5**.

○   **Day 5** (1)

_____

○   Date (2)

_____

○   Special events (3)

_____

The following question will assess how many hot drinks you have had during **Day 5** of your last week. Please indicate a number of hot drinks you had during **Day 5**, and how many of them were drank from a reusable cup.

	Day 5	
	Total hot drinks had (1)	Hot drinks had in a reusable cup (2)

Morning (07 am - 11 am) (1)		
Afternoon (11 am - 3 pm) (2)		
Evening (3 pm - 10 pm) (3)		

Please indicate day, date and special events for **Day 6**.

○ **Day 6** (1)

_____

○ Date (2)

_____

○ Special events (3)

_____

The following question will assess how many hot drinks you have had during **Day 6** of your last week. Please indicate a number of hot drinks you had during **Day 6**, and how many of them were drank from a reusable cup.

	Day 6

	Total hot drinks had (1)	Hot drinks had in a reusable cup (2)
Morning (07 am - 11 am) (1)		
Afternoon (11 am - 3 pm) (2)		
Evening (3 pm - 10 pm) (3)		

Please indicate day, date and special events for **Day 7**.

○   **Day 7** (1)

_____

○   Date (2)

_____

○   Special events (3)

_____

The following question will assess how many hot drinks you have had during **Day 7** of your last week. Please indicate a number of hot drinks you had during **Day 7**, and how many of them were drank from a reusable cup.

	Day 7	
	Total hot drinks had (1)	Hot drinks had in a reusable cup (2)
Morning (07 am - 11 am) (1)		
Afternoon (11 am - 3 pm) (2)		
Evening (3 pm - 10 pm) (3)		

End of Block: Timeline Follow-back

Appendix 3

Interview schedule with lay people

How are you today? How has your day been?

Tell me a little bit about yourself.

We are going to ask you about some habits in your everyday life in this interview. There are no right or wrong answers, we are interested in YOUR opinion on the things we ask.

Tell me about your average day. Let's say a weekday. (wait for an answer) What about a weekend day?

Let's talk a little bit about habits that you might have in your everyday life. Can you tell me what comes to mind when I say 'habit'?

Can you give me some examples of your habits?

> Prompt: When I talk about habits, I generally imagine things like smell of bakery that makes me go and buy a loaf of bread, driving home on autopilot even if you need to go somewhere else, wearing a seatbelt, brushing my teeth etc. Can you tell me a bit about your habits?

You mentioned you have a lot of structure to your day/a little structure. Can you tell me more about it?

What do you think/feel about your habits?

Do you think they are good or bad?

Would you prefer to have more habits in your life or less?

Can you recall any recently acquired habit?

> Prompt: taking a bicycle to Uni, going to the gym, snacking etc.

Can you say you are doing this behaviour without thinking now?

What do you think helped you in the process of forming it?

Interview schedule with experts

How are you today? How has your day been?

Would you like to tell me a little bit about your current research projects/ interests?

I know you have done significant research in the area of habit psychology, particularly in…

We are generally interested in habit definition. First of all I would like to ask you how would you define a habit?

We have conducted interviews with some lay people here in the university, and their definition of habit is quite broad, from basic reflexes, to more complex routines and behaviours. What do you think about that?

Do you think it is important, that researchers and general public to define habit in similar terms and concepts? Why? Why not?

What would you think be a good direction for future research in this area?

Appendix 4

Table 3.1 Examples of Codes within Each Theme with Quotes for Lay People

Theme	Sub-theme	Code name	Description	Quote
Main features of habit	Automaticity	Habit as something automatic	Any mention of habit being something automatic, unconscious, not needing thought, effortless etc.	"I would say habit is something that you kind of become accustomed to over a period of time without requiring a lot of thought or dedication I guess".
	Cue	Cue is important for habit formation	Mentions of triggers, reminders or other features that may trigger, "set off" a habitual behaviour.	"Well I write it in my diary and then I set an alarm, and then I downloaded this app called "Productive" and that app as well tells me to exercise. So it sends you reminders, like, you know just go and do it. So that's definitely helped. Like, diarising and actually just say that I can stick to this. So yeah".
	Reward	Habits make me feel better	Description of positive feelings connected to performing habitual behaviour (alleviating negative feelings, comfort, liking, enjoying, relaxing etc.)	"Face masks is something that relaxes me".

Theme	Sub-theme	Code name	Description	Quote
	Habit as action	Habit as action	Description of habit as behaviour, action, something that you do.	"Something that you unconsciously do".
	Identity	Habit as a second nature	Habit is described as a part of one's identity, personality, something that is naturally describing the person	"I feel like it's something that you've got to do regardless, like that's second nature you know?"
Making and breaking habits	Conscious goal	Habit formation starts from a conscious goal	In order to form a habit, a decision needs to be made first, motivation needs to underlie the initial stages of behaviour	"… with cleaning my room I never used to do that every Saturday. But I just decided to get it done every Saturday morning. I'm never doing anything else at that time. So I just started doing it then. And then it became a habit really".
	Repetition	Repetition as a characteristic of habit	Mentions of repeating behaviour over and over again until it becomes habitual	"… when I just think of habits, I think of something that I do repeatedly".
	Breaking habit	Removing a cue can help breaking a habit	Removing a physical or any other type of cue to help the behaviour from being triggered	"Deleting social media. I've deleted Facebook off my phone but now it's just the other stuff that I think I need to get rid of it. I think that will help".

Table 3.2 Examples of Codes within Each Theme with Quotes for Experts

Theme	Sub-theme	Code name	Description	Quote
Main features of habit	Automaticity	Habit automaticity	Describing habit as an automatic process	"Habits are triggered by a cue and they are performed in some way automatically".
	Cue	Cue as a component of habit	Mentions of cue as a component of habit, habit triggers, cues at any stage of habit formation or breaking process	"There might be lots of substitutable stimuli that would function as cues and also that the cues could be internal so a mood or stress. So for example when I'm particularly stressed I exercise".
	Reward	Reward as a component of habit	Mentions of rewards, reinforcements, whether internal or external, as important components for habit to be formed	"I think a more important dichotomy is natural reward and behaviours that are naturally rewarding are much quicker to become habitual."
	Habit as a process	Habit as a process	Separation of habit as an impulse, mental representation, implicit process from behaviour, action	"… well, first of all I see habit as a process and the reason for that… well… I think we can't see habit as behaviour".
	Other features of habit	Habit as only one part of behaviour		"… And then you start sort of immediately typing and the typing is automatic. But clearly

Theme	Sub-theme	Code name	Description	Quote
				there's consciousness going into the message and so then it's a mixture, then the behaviour becomes a mixture of habits and the sort of conscious behaviour."
Making and breaking habits	Repetition	Repetition as one of the main components of habit formation	Repeating a behavioural sequence again and again in the context in the presence of cues to form a habit. Habit as learning.	"So, for example, repetition is something almost everybody thinks, and some [lay] people picked it."
	Breaking habit	Habit disruption	Mentions of disrupting existing habits	"… an existing habit blocks you from processing something new that you might otherwise be open to. <…> so that's kind of disrupting a status quo habit and then you've got forming a new habit. And all of these things may be required to change people from what they're doing today".
Lay people	Lay definition	How lay people think	Experts talk about how lay people process information, scientific definition, lay literature and concept of habit in general.	"So the introspection problem has two pieces to it, like the general concept is hazy and also the ability to see it. There is also a great old quote, I don't know where it came from but you

Theme	Sub-theme	Code name	Description	Quote
				know, I can't define it but I know it when I see it".
	Same language	Clarity needed in conversation between lay people and experts	Indication of clarity when talking to lay people about habit	"I think if you're trying to engage in interventions you need to have, you need to be clear about what you're talking about".
	Terminology	Need for another term instead of 'habit'	Argument about the need of 'habit' as a term to change within scientific community, in order to distinguish it from lay understandings of habit	"… it could also be an idea to sort of use different terminology with the public for the meaning of habit that we mean, so then it's not sort of competing with their understanding of habit."

Appendix 5

Ethics approval letter for studies 3 and 4 (Chapters 4 and 5)

Curtin University

Research Office at Curtin

GPO Box U1987
Perth Western Australia 6845

Telephone +61 8 9266 7863
Facsimile +61 8 9266 3793
Web research.curtin.edu.au

15-Nov-2018

Name: Barbara Mullan
Department/School: School of Psychology
Email: Barbara.Mullan@curtin.edu.au

Dear Barbara Mullan

RE: Ethics Office approval
Approval number: HRE2018-0739

Thank you for submitting your application to the Human Research Ethics Office for the project **Habit-based intervention for using a reusable hot beverage cup.**

Your application was reviewed through the Curtin University Low risk review process.

The review outcome is: **Approved**.

Your proposal meets the requirements described in the National Health and Medical Research Council's (NHMRC) *National Statement on Ethical Conduct in Human Research (2007)*.

Approval is granted for a period of one year from **15-Nov-2018** to **14-Nov-2019**. Continuation of approval will be granted on an annual basis following submission of an annual report.

Personnel authorised to work on this project:

Name	Role
Mullan, Barbara	Supervisor
Novoradovskaya, Elizaveta	Student
Hasking, Penelope	Supervisor

Approved documents:

Document

Standard conditions of approval

1. Research must be conducted according to the approved proposal
2. Report in a timely manner anything that might warrant review of ethical approval of the project including:

- proposed changes to the approved proposal or conduct of the study
- unanticipated problems that might affect continued ethical acceptability of the project
- major deviations from the approved proposal and/or regulatory guidelines
- serious adverse events

3. Amendments to the proposal must be approved by the Human Research Ethics Office before they are implemented (except where an amendment is undertaken to eliminate an immediate risk to participants)
4. An annual progress report must be submitted to the Human Research Ethics Office on or before the anniversary of approval and a completion report submitted on completion of the project
5. Personnel working on this project must be adequately qualified by education, training and experience for their role, or supervised
6. Personnel must disclose any actual or potential conflicts of interest, including any financial or other interest or affiliation, that bears on this project
7. Changes to personnel working on this project must be reported to the Human Research Ethics Office
8. Data and primary materials must be retained and stored in accordance with the Western Australian University Sector Disposal Authority (WAUSDA) and the Curtin University Research Data and Primary Materials policy
9. Where practicable, results of the research should be made available to the research participants in a timely and clear manner
10. Unless prohibited by contractual obligations, results of the research should be disseminated in a manner that will allow public scrutiny; the Human Research Ethics Office must be informed of any constraints on publication
11. Approval is dependent upon ongoing compliance of the research with the Australian Code for the Responsible Conduct of Research, the National Statement on Ethical Conduct in Human Research, applicable legal requirements, and with Curtin University policies, procedures and governance requirements
12. The Human Research Ethics Office may conduct audits on a portion of approved projects.

Special Conditions of Approval

Please remove the dollar value of the voucher from the Recruitment Material Community Pool and email a revised copy to RQC-ethicshth@curtin.edu.au.

This letter constitutes low risk/negligible risk approval only. This project may not proceed until you have met all of the Curtin University research governance requirements.

Should you have any queries regarding consideration of your project, please contact the Ethics Support Officer for your faculty or the Ethics Office at hrec@curtin.edu.au or on 9266 2784.

Yours sincerely

Amy Bowater
Ethics, Team Lead

Appendix 6

Example of participant information sheet, consent form and questionnaires for Study 3 and 4 (Chapters 4 and 5)

Baseline measures Intervention study

Thank you for showing interest in participating in our research! Before you can proceed, we need to ask you a few questions to determine whether you are eligible to participate in our study. Pick one of the answers to each of the questions. Please be honest in your answers!

Do you generally drink any hot drinks (coffee, tea, hot chocolate or any other hot beverages)?

○ Yes (1)

○ No (2)

Do you own a reusable hot drink cup (a Keepcup, or any other brand, with a lid, that you can carry hot takeaway drinks in)?

○ Yes (1)

○ No (2)

Do you use a smartphone?

○   Yes (1)

○   No (2)

Title of Project: *Intervention to promote environmental behaviour*

What is the Project About?

You are being invited to take part in a research study. We are interested in knowing how people form habits. We want to find out how to form good habits faster and which techniques are best suited for that. We are especially interested in eco-friendly habits, in particular the habit of using a reusable coffee cup. In this study we are conducting an intervention to improve the behaviour of using your reusable coffee cup. This research will hopefully help us to develop effective interventions for other behaviours too.

We are recruiting 120 students to be part of this intervention, which will take place over a 6 week period.

Who is doing the Research?

The project is being conducted by Lisa Novoradovskaya, a postgraduate student in the School of Psychology. The results of this research project will be used by Lisa to obtain a Doctor of Philosophy degree at Curtin University and is funded by the University.

There will be no costs to you to participate, and you will be reimbursed for participating in this project with $15 Coles/Myer gift voucher. You will receive the voucher only if you participate in all data collection points.

Why am I being asked to take part and what will I have to do?

We are inviting Curtin University students, who are studying full-time on Curtin University's Bentley Campus.

Your participation will involve completing online questionnaires four times: a survey before the intervention, during first week of intervention, during week 6 of intervention and follow-up questionnaires after the week 6. The questions will concern your demographics, use of a reusable coffee cup and some personality traits. After filling out the first set of online questionnaires you will be randomly assigned to one of four intervention groups. The intervention will require you to come to Bentley campus to meet with the researcher during a convenient time-slot. The intervention will target one of the factors that research has found to be important for developing regular habits. The intervention will be very simple and brief: you will meet with the researcher and a few other participants for about 20 minutes and do some simple activities, e.g. writing exercises or watching videos. After that you will be instructed on how to fill in the measures during weeks 1 and 6. All the participants will receive a reusable hot drink cup either before or after the intervention. You will be asked to come meet with the researcher on Bentley campus only once. The rest of the study will be done online.

Are there any benefits to being in the research project? You will learn information and techniques in the intervention to help form healthy habits in different areas of your life. We also hope that the results will allow us to add to the knowledge about the process of habit formation and help develop more effective interventions.

Are there any risks, side-effects, discomforts or inconveniences from being in the research project?

There are no foreseeable risks from this research project.

Who will have access to my information?

The information collected in this research will be re-identifiable (coded). This means that we will collect data that can identify you, but will then remove identifying information on any data and replace it with a code when we analyse the data. Only the research team has access to the code to match your name if it is necessary to do so. Any information we collect will be treated as confidential and used only in this project. The following people will have access to the information we collect in this research: the research team and, in the event of an audit or investigation, staff from the Curtin University Office of Research and Development.

Electronic data will be password-protected. The information we collect in this study will be kept under secure conditions at Curtin University for 7 years after the research is published and then it will be destroyed in accordance with Western Australian University Sector Disposal Authority's (WAUSDA) data storage policy. The results of this research may be presented at conferences or published in professional journals. You will not be identified in any results that are published or presented.

<u>Will you tell me the results of the research?</u>

If you are interested in obtaining a summary of the results please send Lisa an email to: <u>elizaveta.novoradovskaya@postgrad.curtin.edu.au</u>.

We will write to you at the end of the research (in October 2019) and let you know the results of the research. Results will not be individual but based on all the information we collect and review as part of the research.

<u>Do I have to take part in the research project?</u>

Taking part in a research project is voluntary. It is your choice to take part or not. You do not have to agree if you do not want to. If you decide to take part and then change your mind, that is okay, you can withdraw from the project. If you choose not to take part or start and then stop the study, it will not affect your relationship with the University, staff or colleagues. With your permission, if you chose to leave the study, we will use any information collected unless you tell us not to.

<u>What happens next and who can I contact about the research?</u>
If you have any questions or require any further information, please contact the researcher.

Principal investigator: A/Prof Barbara Mullan
> E-mail: <u>barbara.mullan@curtin.edu.au</u>
> Telephone: 9266 2468

Co-investigator: Lisa Novoradovskaya
> E-mail: elizaveta.novoradovskaya@postgrad.curtin.edu.au

If you decide to take part in this research we will ask you to tick the consent box below. By ticking it you are telling us that you understand what you have read and

what has been discussed. Ticking the consent box indicates that you agree to be in the research project and have your information used as described. Please take your time and ask any questions you have before you decide what to do. At the start of the questionnaire, available via the link provided, there is a checkbox to indicate you have understood the information provided here in the information sheet.

The following statement must be included in every information sheet: Curtin University Human Research Ethics Committee (HREC) has approved this study (HREC number HRE2018-0739). Should you wish to discuss the study with someone not directly involved, in particular, any matters concerning the conduct of the study or your rights as a participant, or you wish to make a confidential complaint, you may contact the Ethics Officer on (08) 9266 9223 or the Manager, Research Integrity on (08) 9266 7093 or email hrec@curtin.edu.au.

To indicate that you agree with the statements below, please choose 'YES' in the box below.

I confirm that I have read and understood the information sheet provided above.

I have had opportunities to ask questions and my questions have fully been answered.

I understand that my participation is voluntary and that I am free to withdraw at anytime, without giving any reason.

I have received enough information about the study.

I hereby provide my consent to participate in the study.

○ Yes

○ No

Please write your contact e-mail so that we can send you the follow-up surveys. This e-mail will not be used for any identification processes after survey is complete.

_____

Please indicate your student ID below for us to be able to match your first response with your second one. This will not be used to identify your name with your answers.

_____

Please indicate your mobile phone number. If something unexpected happens (e.g. the app used to collect data fails), we would like to be able to contact you to arrange a suitable alternative. Your contact details will not be used for any identification purposes.

_____

Please indicate your gender.

○　　　　Male (1)

○　　　　Female (2)

○　　　　Other Gender (3)

How old are you (in years)?

_____

Are you a first-year undergraduate student at Curtin?

○   Yes (4)

○   No (5)

End of Block: Block 4

Start of Block: Block 6

How often do you drink hot drinks during an average day (coffee, tea, hot chocolate etc.)?

○   Once a day (1)

○   Twice a day (2)

○   Three to five times a day (3)

○   More than five times a day (4)

○   Not every day (5)

Do you use a reusable water bottle?

○   Yes, I use a reusable water bottle all the time (1)

○   Yes, I have one but rarely use it (2)

○   No, I don't use one (3)

Please answer the following questions.
Using a reusable hot drink cup is something...

	Strongly Disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
I do frequently. (1)	○	○	○	○	○	○	○
I do automatically. (2)	○	○	○	○	○	○	○
I do without having to consciously remember. (3)	○	○	○	○	○	○	○
That makes me feel weird if I do not do it. (4)	○	○	○	○	○	○	○
I do without thinking. (5)	○	○	○	○	○	○	○
That would require effort not to do it. (6)	○	○	○	○	○	○	○
That belongs to my daily routine. (7)	○	○	○	○	○	○	○
I start doing before I realise I'm doing it. (8)	○	○	○	○	○	○	○
I would find hard not to do. (9)	○	○	○	○	○	○	○
I have no need to think about doing. (10)	○	○	○	○	○	○	○

That's typically 'me'. (11)	◯ ◯ ◯ ◯ ◯ ◯ ◯
I have been doing for a long time. (12)	◯ ◯ ◯ ◯ ◯ ◯ ◯

Please indicate how much you agree or disagree with the following statements.

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
I intend to use a reusable cup every day over the next week. (1)	◯	◯	◯	◯	◯	◯	◯

Please choose a statement that best corresponds to how much you agree with each item.

	Not at all characteristic of me (1)	A little characteristic of me (2)	Somewhat characteristic of me (3)	Very characteristic of me (4)	Entirely characteristic of me (5)
1. Unforeseen events upset me greatly. (1)	○	○	○	○	○
2. It frustrates me not having all the information I need. (2)	○	○	○	○	○
3. Uncertainty keeps me from living a full life. (3)	○	○	○	○	○
4. One should always look ahead so as to avoid surprises. (4)	○	○	○	○	○
5. A small unforeseen event can spoil everything, even with the best of planning. (5)	○	○	○	○	○
6. When it's time to act, uncertainty paralyses me. (6)	○	○	○	○	○
7. When I am uncertain I can't function very well. (7)	○	○	○	○	○
8. I always want to know what the future has in store for me. (8)	○	○	○	○	○
9. I can't stand being taken by surprise. (9)	○	○	○	○	○
10. The smallest doubt can stop me from acting. (10)	○	○	○	○	○
11. I should be able to organize everything in advance. (11)	○	○	○	○	○

| 12. I must get away from all uncertain situations. (12) | ○ | ○ | ○ | ○ | ○ |

Evaluate the following values in respect to how important they are to you from -1 to 7.

	-1 (Opposed to this value) (1)	0 (This value is not important to me) (2)	1 (3)	2 (4)	3 (5)	4 (6)	5 (7)	6 (8)	7 (This value is extremely important to me) (9)
1. Respecting the earth (1)	○	○	○	○	○	○	○	○	○
2. Unity with nature (2)	○	○	○	○	○	○	○	○	○
3. Protecting the environment (3)	○	○	○	○	○	○	○	○	○
4. Preventing pollution (4)	○	○	○	○	○	○	○	○	○

Read each of these statements and express to which extent they apply to you, using the 5-point scale below:

	Strongly disagree (1)	Disagree (2)	Undecided (3)	Agree (4)	Strongly agree (5)
I really worry about things like climate change. (1)	○	○	○	○	○
I feel anxious sometimes about what climate change will do to us. (2)	○	○	○	○	○
It would be easy for me to adjust my lifestyle so that I can live in harmony with nature. (3)	○	○	○	○	○
There are more important things to do than worry about the environment. (4)	○	○	○	○	○
I often find myself thinking about the issue of sustainable living and how I can make such changes to my lifestyle. (5)	○	○	○	○	○
I am interested in issues related to the environment and climate change. (6)	○	○	○	○	○
I feel that I can really make a contribution to a better environment. (7)	○	○	○	○	○
I feel happy to raise the topic of sustainable living in conversation when I am with other people. (8)	○	○	○	○	○

Read each of these statements and express to which extent they apply to you, using the 5-point scale below:

	Strongly disagree (1)	Disagree (2)	Undecided (3)	Agree (4)	Strongly agree (5)
Using a reusable cup is something everyone should do. (1)	○	○	○	○	○
Because of my values and principles, I feel it is important to try and use the reusable cup. (2)	○	○	○	○	○
I feel a moral obligation to use the reusable cup for the sake of the environment. (3)	○	○	○	○	○

Listed below are statements about the relationship between humans and the environment. Do you agree or disagree that:

	Strongly disagree (8)	Disagree (9)	Somewhat disagree (10)	Unsure (11)	Somewhat agree (12)	Agree (13)	Strongly agree (14)
The so-called "ecological crisis" facing humankind has been greatly exaggerated (4)	○	○	○	○	○	○	○
The earth is like a spaceship with limited room and resources. (5)	○	○	○	○	○	○	○
If things continue on their present course, we will soon experience a major ecological catastrophe. (6)	○	○	○	○	○	○	○
The balance of nature is strong enough to cope with the impacts of modern industrial nations. (7)	○	○	○	○	○	○	○
Humans are severely abusing the environment. (8)	○	○	○	○	○	○	○

End of Block: Block 6

Start of Block:

Now you will be asked to pick a suitable time for you to meet up with the researcher and receive your intervention. Please select the most suitable time and make a note of it. If none of these times are suitable for you, please email Lisa at: elizaveta.novoradovskaya@postgrad.curtin.edu.au.

Meeting location: lobby of building 401, in the reception area on the second floor (entrance in front of Concept Cafe and Co-op).

Follow-up measures Intervention study

Participant Information Sheet

Title of Project: *Intervention to promote environmental behaviour*

Thank you for participating in our research study! We ask you to fill in the follow-up measures, which are very similar to the questions you answered before participating in the intervention. There are a few questions about your personality, your relationship with the environment, your use of a reusable drink cup and a couple of questions about the study itself. You will also have a chance to participate in a short interview to enter a prize draw. After you complete this questionnaire, you will be awarded your $15 Coles/Myer gift e-voucher and will be sent a short summary of the study by email.

If you are interested in obtaining a summary of the results please send Lisa an email to: elizaveta.novoradovskaya@postgrad.curtin.edu.au. We will write to you at the end of the research (in October 2019) and let you know the results of the research. Results will not be individual but based on all the information we collect and review as part of the research. If you have any questions or require any further information, please contact the researcher.

Principal investigator: A/Prof Barbara Mullan
E-mail: barbara.mullan@curtin.edu.au
Telephone: 9266 2468
Co-investigator: Lisa Novoradovskaya
E-mail: elizaveta.novoradovskaya@postgrad.curtin.edu.au

If you decide to take part in this research we will ask you to tick the consent box below. By ticking it you are telling us that you understand what you have read and what has been discussed. Ticking the consent box indicates that you agree to be in the research project and have your information used as described. Please take your time and ask any questions you have before you decide what to do.

At the start of the questionnaire, available via the link provided, there is a checkbox to indicate you have understood the information provided here in the information sheet.

The following statement must be included in every information sheet: Curtin University Human Research Ethics Committee (HREC) has approved this study (HREC number HRE2018-0739). Should you wish to discuss the study with someone not directly involved, in particular, any matters concerning the conduct of the study or your rights as a participant, or you wish to make a confidential complaint, you may contact the Ethics Officer on (08) 9266 9223 or the Manager, Research Integrity on (08) 9266 7093 or email hrec@curtin.edu.au.

To indicate that you agree with the statements below, please choose 'YES' in the box below.

I confirm that I have read and understood the information sheet provided above.

I have had opportunities to ask questions and my questions have fully been answered.

I understand that my participation is voluntary and that I am free to withdraw at anytime, without giving any reason.

I have received enough information about the study. I hereby provide my consent to participate in the study.

○   Yes

○   No

Please write your contact e-mail, so that you can be awarded your gift voucher for the study and sent a short summary of the research. This e-mail will not be used for any identification purposes after survey is complete.

_____

Please indicate your student ID below for us to be able to match your first response with your second one. This will not be used to identify your name with your answers.

_____

How often do you drink hot drinks during an average day (coffee, tea, hot chocolate etc.)?

○　　　　　　Once a day (1)

○　　　　　　Twice a day (2)

○　　　　　　Three to five times a day (3)

○　　　　　　More than five times a day (4)

○　　　　　　Not every day (5)

Have you been using a reusable hot drink cup in the past 6 weeks?

○　　　　　　Once or more times a day (1)

○　　　　　　A few times a week (2)

○　　　　　　Once a week (3)

○　　　　　　Less than once a week (4)

○　　　　　　Never (5)

Please answer the following questions.
Using a reusable hot drink cup is something...

	Strongly Disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
I do frequently. (1)	○	○	○	○	○	○	○
I do automatically. (2)	○	○	○	○	○	○	○
I do without having to consciously remember. (3)	○	○	○	○	○	○	○
That makes me feel weird if I do not do it. (4)	○	○	○	○	○	○	○
I do without thinking. (5)	○	○	○	○	○	○	○
That would require effort not to do it. (6)	○	○	○	○	○	○	○
That belongs to my daily routine. (7)	○	○	○	○	○	○	○
I start doing before I realise I'm doing it. (8)	○	○	○	○	○	○	○
I would find hard not to do. (9)	○	○	○	○	○	○	○
I have no need to think about doing. (10)	○	○	○	○	○	○	○

That's typically 'me'. (11) ○　○　○　○　○　○　○

I have been doing for a long time. (12) ○　○　○　○　○　○　○

Please indicate how much you agree or disagree with the following statements.

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
I intend to use a reusable cup every day over the next week. (1)	○	○	○	○	○	○	○

Please choose a statement that best corresponds to how much you agree with each item.

	Not at all characteristic of me (1)	A little characteristic of me (2)	Somewhat characteristic of me (3)	Very characteristic of me (4)	Entirely characteristic of me (5)
1. Unforeseen events upset me greatly. (1)	○	○	○	○	○
2. It frustrates me not having all the information I need. (2)	○	○	○	○	○
3. Uncertainty keeps me from living a full life. (3)	○	○	○	○	○
4. One should always look ahead so as to avoid surprises. (4)	○	○	○	○	○

5. A small unforeseen event can spoil everything, even with the best of planning. (5)	○	○	○	○	○
6. When it's time to act, uncertainty paralyses me. (6)	○	○	○	○	○
7. When I am uncertain I can't function very well. (7)	○	○	○	○	○
8. I always want to know what the future has in store for me. (8)	○	○	○	○	○
9. I can't stand being taken by surprise. (9)	○	○	○	○	○
10. The smallest doubt can stop me from acting. (10)	○	○	○	○	○
11. I should be able to organize everything in advance. (11)	○	○	○	○	○
12. I must get away from all uncertain situations. (12)	○	○	○	○	○

Evaluate the following values in respect to how important they are to you from -1 to 7.

	-1 (Opposed to this value) (1)	0 (This value is not important to me) (2)	1 (3)	2 (4)	3 (5)	4 (6)	5 (7)	6 (8)	7 (This value is extremely important to me) (9)
1. Respecting the earth (1)	○	○	○	○	○	○	○	○	○
2. Unity with nature (2)	○	○	○	○	○	○	○	○	○
3. Protecting the environment (3)	○	○	○	○	○	○	○	○	○
4. Preventing pollution (4)	○	○	○	○	○	○	○	○	○

Read each of these statements and express to which extent they apply to you, using the 5-point scale below:

	Strongly disagree (1)	Disagree (2)	Undecided (3)	Agree (4)	Strongly agree (5)
I really worry about things like climate change. (1)	○	○	○	○	○
I feel anxious sometimes about what climate change will do to us. (2)	○	○	○	○	○
It would be easy for me to adjust my lifestyle so that I can live in harmony with nature. (3)	○	○	○	○	○
There are more important things to do than worry about the environment. (4)	○	○	○	○	○
I often find myself thinking about the issue of sustainable living and how I can make such changes to my lifestyle. (5)	○	○	○	○	○
I am interested in issues related to the environment and climate change. (6)	○	○	○	○	○

| I feel that I can really make a contribution to a better environment. (7) | ○ | ○ | ○ | ○ | ○ |
| I feel happy to raise the topic of sustainable living in conversation when I am with other people. (8) | ○ | ○ | ○ | ○ | ○ |

- -

Read each of these statements and express to which extent they apply to you, using the 5-point scale below:

	Strongly disagree (1)	Disagree (2)	Undecided (3)	Agree (4)	Strongly agree (5)
Using a reusable cup is something everyone should do. (1)	○	○	○	○	○
Because of my values and principles, I feel it is important to try and use the reusable cup. (2)	○	○	○	○	○
I feel a moral obligation to use the reusable cup for the sake of the environment. (3)	○	○	○	○	○

Listed below are statements about the relationship between humans and the environment. Do you agree or disagree that:

	Strongly disagree (8)	Disagree (9)	Somewhat disagree (10)	Unsure (11)	Somewhat agree (12)	Agree (13)	Strongly agree (14)
The so-called "ecological crisis" facing humankind has been greatly exaggerated. (4)	○	○	○	○	○	○	○
The earth is like a spaceship with limited room and resources. (5)	○	○	○	○	○	○	○
If things continue on their present course, we will soon experience a major ecological catastrophe. (6)	○	○	○	○	○	○	○
The balance of nature is strong enough to cope with the impacts of modern industrial nations. (7)	○	○	○	○	○	○	○
Humans are severely abusing the environment. (8)	○	○	○	○	○	○	○

End of Block: Block 6

Intervention evaluation questionnaire

Please evaluate these questions on a scale from 1 to 7, where 1 = Strongly disagree, 4 = Unsure, 7 = Strongly Agree. Did you find the **intervention contents** (the information the researcher provided to you at the meeting):

	Strongly Disagree (1)	Disagree (2)	Somewhat Disagree (3)	Unsure (4)	Somewhat Agree (5)	Agree (6)	Strongly Agree (7)
1. Useful. (1)	○	○	○	○	○	○	○
2. Interesting. (2)	○	○	○	○	○	○	○
3. Credible. (3)	○	○	○	○	○	○	○
4. Easy to understand. (4)	○	○	○	○	○	○	○
5. Personally relevant. (5)	○	○	○	○	○	○	○
6. Too long. (6)	○	○	○	○	○	○	○
7. Annoying. (7)	○	○	○	○	○	○	○

If you have any additional comments about the **contents of the intervention**, please write them below:

_____

Please evaluate these questions on a scale from 1 to 7, where 1 = Strongly disagree, 4 = Unsure, 7 = Strongly Agree. Did you find using (installing, registering and answering the questions) the **Instant Survey app**:

	Strongly Disagree (1)	Disagree (2)	Somewhat Disagree (3)	Unsure (4)	Somewhat Agree (5)	Agree (6)	Strongly Agree (7)
1. Annoying. (1)	○	○	○	○	○	○	○
2. Easy. (8)	○	○	○	○	○	○	○
3. Useful (2)	○	○	○	○	○	○	○

If you have any additional comments about **Instant Survey app**, please write them below:

_____

End of Block: Feasibility

Appendix 7

Table 4.2. Descriptive analysis of variables at time one: means (*M*), standard deviations (*SD*) and bivariate correlations (Pearson); *N* = 156.

Variable	*M*	*SD*	Intention	Habit Strength	Biospheric values	Personal involvement	Personal Norms	New Environmental Paradigm	Intolerance of uncertainty	Use of reusable cup
Intention	4.42	1.64		.452***	.270**	.414***	.276***	.035	-.117	-.102
Habit strength	2.63	1.10			.237**	.296***	.305***	-.003	.129	.012
Biospheric values	7.46	1.11				.596***	.534***	.227**	-.098	.048
Personal involvement	3.74	0.59					.576***	.362***	-.036	-.084
Personal norms	4.10	0.62						.326***	.040	.005
New Environmental Paradigm	5.59	0.81							.003	-.067
Intolerance of uncertainty	33.58	10.29								.123
Use of reusable cup	28.92	28.63								

Notes: *** Correlation is significant at *p* < 0.001; ** Correlation significant at *p* < 0.01; *Correlation is significant at *p* < 0.05

Table 4.3 Descriptive analysis of variables at time two: means (*M*), standard deviations (*SD*) and bivariate correlations (Pearson); *N* = 156.

Variable	*M*	*SD*	Intention	Habit Strength	Biospheric values	Personal involvement	Personal Norms	New Environmental Paradigm	Intolerance of uncertainty	Use of reusable cup
Intention	5.15	1.66		.558***	.354**	.407***	.454***	.156	.012	.145
Habit strength	3.81	1.51			.474**	.496***	.476***	-.015	.169*	.340***
Biospheric values	7.72	1.04				.567***	.550***	.124	.170*	.152
Personal involvement	3.86	.55					.606***	.259**	.135	.137
Personal norms	4.33	.61						.192*	.215**	.239**
New Environmental Paradigm	5,71	.85							.002	.016
Intolerance of uncertainty	33.78	10.77								.173*
Use of reusable cup	25.89	30.73								

Notes: *** Correlation is significant at *p* < 0.001; ** Correlation significant at *p* < 0.01; *Correlation is significant at *p* < 0.05

Table 4.4 Descriptive analysis of variables at time one[1] and time two[2]: means (*M*), standard deviations (*SD*) and bivariate correlations (Pearson); *N* = 156.

Variable	M	SD	Intention[1]	Habit Strength[1]	Biospheric Values[1]	Personal Involvement[1]	Personal Norms[1]	New Environmental Paradigm[1]	Intolerance of uncertainty[1]	Use of reusable cup[1]	Intention[2]	Habit Strength[2]	Biospheric Values[2]	Personal Involvement[2]	Personal Norms[2]	New Environmental Paradigm[2]	Intolerance of uncertainty[2]	Use of reusable cup[2]
Intention[1]	4.42	1.64		.452***	.270**	.414***	.276***	.035	-.117	-.102	.380***	.420***	.202*	.278***	.251**	-.022	-.079	-.067
Habit strength[1]	2.63	1.10			.237**	.296***	.305***	-.003	.129	.012		.381***	.215**	.267**	.155	-.001	.161*	-.002
Biospheric values[1]	7.46	1.11				.596***	.534***	.227**	-.098	.048			.533***	.399***	.323***	.077	-.039	.071
Personal involvement[1]	3.74	0.59					.576***	.362***	-.036	-.084				.614***	.383***	.168*	.014	-.002
Personal norms[1]	4.10	0.62						.326***	.040	.005					.469***	.185*	.064	.009

Variable	M	SD	Intention[1]	Habit Strength[1]	Biospheric Values[1]	Personal Involvement[1]	Personal Norms[1]	New Environmental Paradigm[1]	Intolerance of uncertainty[1]	Use of reusable cup[1]	Intention[2]	Habit Strength[2]	Biospheric Values[2]	Personal Involvement[2]	Personal Norms[2]	New Environmental Paradigm[2]	Intolerance of uncertainty[2]	Use of reusable cup[2]
New Environmental Paradigm[1]	5.59	0.81							.003	-.067						.552***	.031	-.041
Intolerance of uncertainty[1]	33.58	10.29								.123							.795***	.143
Use of reusable cup[1]	28.92	28.63																.858***
Intention[2]	5.15	1.66										.558***	.354**	.407***	.454***	.156	.012	.145
Habit strength[2]	3.81	1.51	.										.474**	.496***	.476***	-.015	.169*	.340***

Variable	M	SD	Intention[1]	Habit Strength[1]	Biospheric Values[1]	Personal Involvement[1]	Personal Norms[1]	New Environmental Paradigm[1]	Intolerance of uncertainty[1]	Use of reusable cup[1]	Intention[2]	Habit Strength[2]	Biospheric Values[2]	Personal Involvement[2]	Personal Norms[2]	New Environmental Paradigm[2]	Intolerance of uncertainty[2]	Use of reusable cup[2]
Biospheric values[2]	7.72	1.04												.567***	.550***	.124	.170*	.152
Personal involvement[2]	3.86	.55													.606***	.259**	.135	.137
Personal norms[2]	4.33	.61														.192*	.215**	.239**
New Environmental Paradigm[2]	5,71	.85															.002	.016
Intolerance of uncertainty[2]	33.78	10.77																.173*

Variable	M	SD	Intention[1]	Habit Strength[1]	Biospheric Values[1]	Personal Involvement[1]	Personal Norms[1]	New Environmental Paradigm[1]	Intolerance of uncertainty[1]	Use of reusable cup[1]	Intention[2]	Habit Strength[2]	Biospheric Values[2]	Personal Involvement[2]	Personal Norms[2]	New Environmental Paradigm[2]	Intolerance of uncertainty[2]	Use of reusable cup[2]
Use of reusable cup[2]	25.89	30.73																

Notes: *** Correlation is significant at $p < 0.001$; ** Correlation significant at $p < 0.01$; *Correlation is significant at $p < 0.05$

Appendix 8

Appendix 8.1.

Permission from Journal of Consumer Behaviour to use publication as part of thesis (screenshot from the Wiley website).

Do I need to request permission to use my own work as my dissertation?

If you are the author of a published Wiley article, you have the right to reuse the full text of your published article as part of your thesis or dissertation. In this situation, you do not need to request permission from Wiley for this use.

Appendix 8.2.

Permission from Journal of Cleaner Production to use publication as part of thesis (screenshot from the Elsevier website).

Author rights

The below table explains the rights that authors have when they publish with Elsevier, for authors who choose to publish either open access or subscription. These apply to the corresponding author and all co-authors.

Author rights in Elsevier's proprietary journals	Published open access	Published subscription
Retain patent and trademark rights	√	√
Retain the rights to use their research data freely without any restriction	√	√
Receive proper attribution and credit for their published work	√	√
Re-use their own material in new works without permission or payment (with full acknowledgement of the original article): 1. Extend an article to book length 2. Include an article in a subsequent compilation of their own work 3. Re-use portions, excerpts, and their own figures or tables in other works.	√	√
Use and share their works for scholarly purposes (with full acknowledgement of the original article): 1. In their own classroom teaching. Electronic and physical distribution of copies is permitted 2. If an author is speaking at a conference, they can present the article and distribute copies to the attendees 3. Distribute the article, including by email, to their students and to research colleagues who they know for their personal use 4. Share and publicize the article via Share Links, which offers 50 days' free access for anyone, without signup or registration 5. Include in a thesis or dissertation (provided this is not published commercially) 6. Share copies of their article privately as part of an invitation-only work group on commercial sites with which the publisher has a hosting agreement	√	√