Master's thesis

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Just A Bag Habit?

A Multimethod Study of the Psychological Predictors of Plastic Bag Usage

Master's thesis in General Psychology
Supervisor: Isabel Richter
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Abstract

Plastic has evolved into a widespread, inexpensive, single-use material over time, despite growing awareness of its impact on the environment, health, and society. Worldwide, single-use plastic bags rank among the most commonly littered objects. Given the environmental threat posed by the extensive use of single-use plastic bags, this study aims to investigate the role of habits as a predictor of plastic bag behavior, along with other psychological predictors to extend knowledge gained in a similar study conducted in South Africa, allowing for a cross-cultural comparison. Focused on Norwegian consumers, the study employs a multi-method approach using survey questionnaires and in-store behavioral observations, garnering data from 540 respondents and 285 in-store observations. Survey results highlight the significance of habits, intentions to reduce plastic bag consumption, social norms, cost, and convenience in self-reported behavior of bringing one's own bag to store. Observational findings shed light on cashier prompts' impact on plastic bag purchases, with individuals who bring their own bag demonstrating a decreased likelihood of purchasing plastic. Notably, 54% of customers bring their own bag, contrasting with 40% who opt for plastic bags. No age and gender differences could be found. Results are compared to the findings of the South African study. The study's findings align with previous literature in the field, emphasizing the significant impact of habits in shaping behavior. Additionally, it highlights how habits can surpass individuals' intentions to act sustainably, underscoring the necessity of habit change to reduce plastic consumption.

Sammendrag

Plast har over tid utviklet seg til å bli et utbredt, billig engangsmateriale, til tross for økende bevissthet om dets innvirkning på miljø, helse og samfunn. På verdensbasis er plastposer blant de mest forsøplede gjenstandene. Gitt den miljømessige trusselen den omfattende bruken av plastposer utgjør, er denne studiens mål å undersøke vaners rolle når det kommer til prediksjon av plastposeatferd, i tillegg til flere psykologiske prediktorer, for å utvide kunnskapen knyttet til funnene i en lignende studie gjennomført i Sør-Afrika. Dette åpner videre for en krysskulturell sammenligning. Med fokus på norske forbrukere, benytter studien en flermetodetilnærming gjennom bruk av spørreskjema og atferdsobservasjoner i butikk, og samler inn data fra 540 respondenter og 285 observasjoner. Resultatene fremhever betydningen av vaner, intensjoner om å redusere plastbruk, sosiale normer, kostnader og bekvemmelighet gjennom selvrapportert atferd. Funn fra observasjonene belyser kassepersonellets innvirkning på kjøp av plastposer, hvor personer som tar med egne poser til dagligvarehandel viser en lavere sannsynlighet for å kjøpe plastposer. Av disse tar 54% av observerte kunder med egen pose, i motsetning til 40% som velger å kjøpe plastpose, hvor kjønn og alder viser seg å være ikke-signifikant. Resultatene sammenlignes så med funnene fra den sørafrikanske studien. Studiens resultater stemmer videre overens med tidligere forskning på feltet, og understreker påvirkningen vaner har på formingen av atferd. I tillegg fremheves vaners tendens til å overgå individers intensjoner om å handle bærekraftig, og understreker på denne måten nødvendigheten av vaneendring for å redusere plastforbruk.

Preface

This master's thesis marks the end of five years as a psychology student at NTNU. This entire process has led to a wealth of new knowledge and great experiences, and it is with pride and a touch of sadness that I now close this chapter. There are many people I would like to thank for making this possible. First and foremost, I would like to thank my supervisor, Isabel Richter, for all her input and feedback throughout the process, and especially for including me in her projects. It has provided me with valuable knowledge and sometimes steep learning curves, but ones I am very grateful for.

As my time as a student is coming to an end, I would like to thank all the wonderful people I have gotten to know during my years at Dragvoll, and especially those who have been my closest friends and classmates over the past two years. Thank you for all the social gatherings both inside and outside the classroom, long lunch breaks, and motivation along the way. Finally, I want to thank my fiancé and family for listening to my endless talking about my studies, for all the encouraging words and support.

Tonje Nerkvern

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Introduction

Imagine you are going for your weekly trip to the grocery store. As you approach the supermarket entrance, a sinking feeling washes over you – you had forgotten your reusable shopping bag. Annoyance followed by guilt settles in your chest. You consider yourself rather environmentally conscious, yet here you are, about to contribute to the ever-growing pile of plastic waste. As you reach the checkout counter, the unavoidable confrontation with the plastic bag draws nearer. With a resigned sigh, you accept the bags offered by the cashier – you simply can't carry all those groceries with your bare hands, right? Back home you feel disappointment gnawing at your conscience. You had failed to uphold your commitment to sustainability, giving in to convenience over conscientiousness. So, why did you forget your reusable bag in the first place? Was it simply distractedness, or could there be other explanations for this?

Reflecting on this experience, several factors could have influenced the behavior under question. A busy day-to-day life will surely play a role, acting as a distractor. However, one of the most significant barriers for this behavior is your *habits.* Despite having the best intentions, habitual behavior led you to rely on something familiar or easy, like reaching for a plastic bag. Habits like these can get in the way of doing the right thing, especially when the behavior of bringing your own bag hasn't become a habit yet.

This scenario could be a reflection of a greater reality in most countries worldwide. Whether it is the individual's choice or designated packers who make the decision, the reliance on plastic bags persists as a common practice. In this complicated balance of internal and external influence, the impact on the environment continues to be prominent, highlighting the need for individual action and a shift towards more mindful consumption habits. Therefore, this thesis will be focusing on habits as an impactful source of behavior, along with other psychological factors that contribute to plastic consumption.

Numerous studies indicate that the consumption of plastic bags is highly habitual, forming everyday routines that individuals find challenging to change or break. This habitual nature often creates a loop, wherein people continue using plastic bags despite having intentions to reduce their environmental impact. To gain a deeper insight into the habits and behaviors related to plastic bag consumption in Norwegian consumers, the study will incorporate both observation and survey methods. By comparing consumers in Norway and South Africa, the study aims to elucidate cultural and contextual influences on plastic bag consumption, providing a thorough understanding of consumer behavior and avoidance. The following sections will deliberate on the theoretical framework and hypotheses with an emphasis on habits, followed by other predictors of behavior, present data sources and research methods, including the research sample, measurements, and analytical strategies. Finally, the study results and implications will be discussed.

Background

Psychological factors, such as habits, norms, and intentions, all play a crucial role in shaping one's environmental behavior, reflecting the interplay between individual attitudes and motivations. Environmental behavior can be defined as various actions that influence the availability of resources and energy in the environment and can impact the structure and functioning of ecosystems and the biosphere (Gatersleben, 2019). A change of behavior is seen as necessary to improve the environmental situation of the world. This type of behavior refers to what is known as pro-environmental behavior, which includes actions, choices, and practices that individuals or groups undertake to minimize their negative impact on the environment and promote the well-being of the planet (Gatersleben, 2019; Tian & Liu, 2022).

The world's first fully synthetic plastic was innovated in 1907 by L. Baekeland, a Belgian chemist, coining the term "plastic" (Helseth, 2021). This invention marked the beginning of the modern era of plastics and paved way for the development of many other types of synthetic polymers. Today, numerous plastic types are produced, and have become integral to modern life, offering properties like durability, flexibility, and cost-effectiveness. With its diverse types, sizes, colors and sources, it is reflecting on the extensive demand for various plastic products in our daily lives. However, this success has led to environmental challenges, as plastics' slow decomposition causes widespread pollution (Priya et al., 2022; Rodrigues et al., 2019). Reportedly, less than 10% of discarded plastic has been recycled, contributing to environmental issues related to their release into ecosystems during the production lifecycle (UNEP, 2021).

When entering the natural environment, plastics can be transported from land to rivers and eventually the ocean due to for instance weather conditions (Hohn et al., 2020; Horton & Dixon, 2018). Plastic pollution enters these systems through various pathways, such as mishandled waste, landfills, agricultural activities, wastewater treatment plants, and human

activities. Out of the 8.3 billion tons of virgin plastic produced since 1950, approximately 6.3 billion tons have become plastic waste, with about 79% of it ending up in landfills or the natural environment (Geyer et al., 2017; Mazhandu et al., 2020). Each year, an estimated 8 to 9 million tons of plastic find their way into the oceans. Packaging applications constitute roughly half of the total plastic production, and since most packaging is single-use and short-lived, it contributes significantly to the overall plastic waste problem (Rodrigues et al., 2019; Stafford et al., 2022).

Anthropogenic Plastic Pollution

Plastic is a versatile material that is used and found in numerous daily activities (Sadan & De Kock, 2020), such as packaging for foods and drinks, safety products, consumer goods, clothing, and household items (Ügdüler et al., 2020). There are various ways to define and understand the term “plastic”, but most commonly, it refers to a range of end-products, such as cups, bags, straws, packaging and containers, composed of materials like polyethylene (PE), polypropylene (PP) and polystyrene (PS) (Li et al., 2021; Nagtzaam et al., 2023). Plastics offer numerous advantages, including their lightweight construction and durability, which make them especially beneficial in comparison to other materials (Priya et al., 2022). For instance, in the medical sector, plastic packaging plays a crucial role in maintaining equipment sterility and secure storage (Sadan & De Kock, 2020).

Together with the escalating global production of plastic, its advantages also come with a host of adverse effects. The growing trend in plastic production and consumption, combined with challenges in waste services – including the lack of controlled, safe, and affordable services – and inadequate waste management, particularly in developing nations, leads to plastic pollution (Stafford et al., 2022; Wilson & Velis, 2015). Plastic pollution can be broadly defined as the introduction of plastics, regardless of their characteristics, into the environment, posing potential threats to ecosystems, organisms, and human well-being (Li et

al., 2021; MacLeod et al., 2021). Plastics can also act as carriers for persistent organic pollutants (POPs), heavy metals, and microorganisms, releasing chemicals into the environment (Alharbi et al., 2018), and are therefore considered sources of certain toxic substances. As plastic items undergo weathering, it initially goes through fragmentation, breaking down into smaller pieces known as plastic debris or microplastics, and eventually nano plastics. Microplastics in particular, are increasingly found in living organisms and the human food chain, posing risks such as potential inhalation and ingestion, as well as their presence in the human placenta and tissue (Ragusa et al., 2021; Rodrigues et al., 2019; Stafford et al., 2022; Waring et al., 2018).

Not only does plastic pollution affect the surrounding environment in various ways, but it also has socio-economic consequences. It impacts fishing stocks and industry, alters the aesthetics of beaches and natural areas, blocks drainage systems and wastewater treatment facilities, and provides breading grounds for waterborne diseases (Muposhi et al., 2021; Stafford et al., 2022). In certain countries, plastic pollution could ultimately impact the tourism industry (Oyake-Ombis et al., 2015) thereby affecting the economic well-being of the nation. Moreover, the cost associated with cleanup efforts can pose significant financial burdens.

The Sustainable Development Goals

In September 2015, the United Nations established the Sustainable Development Goals (SDGs) - the world's collective agenda for ending poverty, combating inequality, and mitigating climate change by 2030. It consists of seventeen goals, each with a number of sub-goals, and the goals act as a common global direction for countries, businesses, and the civil society (UNEP, 2023). Sustainable Development Goal number 12, “Responsible consumption and production” is about ensuring sustainable consumption and production patterns, which are key to sustaining the livelihoods of current and future generations. It emphasizes a change in

our consumption habits towards more sustainable ones as one of the main changes we need to make if we want to reduce our overall consumption level (UNEP, 2023).

The UN states that the world, collectively, is showing increased levels of commitment and awareness that sustainability should be at core of business practices. Also, individuals are constantly reminded of feasible measures to take by adopting more sustainable lifestyles, including consuming less, choosing products with lower environmental impacts, and reducing the carbon footprint in our daily activities (UNEP, 2023). The UN suggests two main ways consumers can help: 1) by reducing their own waste and 2) by being thoughtful about what to buy and choosing more sustainable options when possible. Other suggestions for acting in a more sustainable way in our everyday lives include carrying a reusable bag, refusing to use plastic straws and cutlery, and recycling plastic bottles.

Status Quo in Norway

While there is uncertainty surrounding the statistics on the total plastic usage and waste in Norway, estimates suggest that around 3.1 million tons of plastic are currently in use (Norwegian Ministry of Climate and Environment et al., 2022). Most of this is found in building and construction materials, plastics in vehicles, and various other products such as packaging. It is estimated that approximately 540,000 tons of plastic currently in use transition into waste each year. Thus, it is likely that Norway uses more plastics in the marine sector, as the country aspires to be a leading maritime nation. Part of this aspiration also involves concerted efforts to prevent and reduce marine plastic litter and plastic pollution (Norwegian Ministry of Climate and Environment et al., 2022).

The Norwegian Government aims to contribute to a more sustainable global, national, and regional plastics value chain (Norwegian Ministry of Climate and Environment et al., 2022). Their strategy serves as a cohesive framework for the government's plastics policy, outlining a set of measures that have been or are being implemented to reduce plastic litter

and pollution. Within the strategy, there is a collective effort to promote the usage of sustainable plastic products and encourage responsible plastic consumption. This includes reducing the quantity of plastic waste left unutilized for recycling and preventing plastic waste from entering the environment (Norwegian Ministry of Climate and Environment et al., 2022). This involves designing all new plastic packaging for cost-effective recycling or reuse, aligning with the EU's plastics strategy (European Commission, 2018; Ügdüler et al., 2020). Furthermore, the strategy includes plans to implement measures such as banning single-use items like plastic straws and disposable plastic cutlery, imposing higher fees for plastic carrier bags, and promoting local initiatives for nature and beach cleanup.

Although Norway has a relatively high per capita use of plastic carrier bags, the overall plastic recycling rates are quite good, with 28% of plastics from households and businesses being materially recycled in 2020, according to recycling companies' reporting (Avfall Norge, n.d.). Nevertheless, there is no doubt that marine litter poses a significant environmental challenge in Norway (Miljøstatus, n.d.). A substantial portion of plastic waste sinks and remains on the seabed, contributing to its unobtrusiveness in urban and rural landscapes. Land-based litter, such as overflow from bins or direct littering, is often carried by wind, rivers, or rain into the sea. Approximately 2% (or 10,000 tons) of Norway's plastic waste in 2020 found its way into the nature, primarily as packaging, electronic waste, and fishing gear (Systemiq et al., 2023). However, precise data on how much waste is found in Norwegian seas remains limited (Miljøstatus, n.d.).

According to data from Handelens Miljøfond (*Norwegian Retailers' Environment Fund*) in 2022, plastic carrier bag consumption in Norway reached approximately 722 million plastic bags, averaging about 132 bags per person per year. To comply with the EU directive, Norway aims to reduce annual plastic carrier bag consumption to 40 bags per capita by the end of 2025 (Miljødirektoratet, n.d.). Since the introduction of the plastic carrier bag levy in

the early 1990's, there has been a constant increase in the cost, from 0,20 NOK (0.019 USD) to the current 4,25 NOK (0.40 USD) per single-use plastic bag. Part of the cost is retailer's commission paid to Handelens Miljøfond, which is Norway's largest private environmental fund, working towards reducing the consumption of plastic carrier bags, preventing plastic pollution, contributing to reduced overall consumption of plastic and a circular plastics economy.

In a report by Mepex and Systemiq (2023) for Handelens Miljøfond, it was revealed that over 80% of plastic carrier bags bought in Norway are used as waste bags, particularly for residual waste. Furthermore, sorting analyses show that the remainder of plastic bags in waste are either loose in the residual waste or plastic waste, or used for collection and storing of plastic packaging, glass and metal packaging or deposit packaging. However, according to the report, 109 million plastic carrier bags could probably have been reused, based on the number of whole and clean plastic bags that are thrown into residual or sorted waste.

Status Quo in South Africa

South Africa has been ranked 11th out of 192 coastal countries in terms of mismanaged plastic waste leaking into the environment (Jambeck et al., 2015), making the country a significant contributor to global marine plastic pollution. Plastic carrier bags have garnered special attention in the country as they were previously distributed to consumers free of charge, contributing to their extensive use. This, combined with improper disposal and inadequate waste management, has contributed significantly to widespread plastic pollution, earning them the nickname of the country's "national flower" (Stafford et al., 2022), as they are caught by trees when blown away with the wind.

South Africa generates up to three million tons of plastic waste every year, with an average of 41 kg plastic waste per citizen annually (Mazhandu et al., 2021; Sadan & De Kock, 2020), compared to approximately two million tons and 36 kg per citizen in 2018. Plastic

consumption per capita is predicted to increase over the next few years due to urbanization, urban-rural migration, and an increase in middle-income households. However, only 14% of the nearly 3 million tons of plastic thrown into bins are recycled, leaving out the portion that is not discarded in bins. South Africans consume approximately eight billion plastic carrier bags annually, according to Dikgang and colleagues (2012a), which contribute to South Africa ranking the highest in mismanaged plastic waste in Africa (Neef et al., 2023; see also Meijer et al., 2021; Nyathi & Togo, 2020). Since the early 2000s, South Africa has attempted to introduce various interventions to reduce plastic carrier bag consumption and littering. Prior to these interventions, plastic carrier bags were given out for free in local grocery stores and were not recyclable. In 2002, the South African government, alongside representatives of labor and industry, signed an agreement concerning the growing waste problem and the use of disposable PE carrier bags (Dikgang et al., 2012a). Some of the key points in the agreement included regulating the minimum thickness (μm) of plastic carrier bags, ensuring disclosure and transparency about the costs of carrier bags, promoting a market for recycled materials, and other measures.

This resulted in South Africa becoming one of the leading developing countries to adopt a plastic carrier bag levy shortly after. The levy started at 46 ZAR cents (0.03 USD) and was later lowered to 32 ZAR cents (0.02 USD) (Dikgang et al., 2012b; O'Brien & Thondhlana, 2019). Unfortunately, the plastic bag levy only led to short-term reductions in the population's plastic carrier bag consumption (Neef et al., 2023), regardless of retailers' compliance. In the first few months, there was a reduction in plastic carrier bag manufacturing of up to 80% (Hasson et al., 2007; O'Brien & Thondhlana, 2019). However, shortly after, consumption rose to 30% of "the original production capacity" and has continued to rise since (Hasson et al., 2007), despite efforts to reduce consumption, presumably due to its affordability.

The purchase of plastic bags at the checkout tills has become a strongly habitual behavior among South Africans, which seems to persist despite levies, the availability of various alternatives, and campaigns to discourage it (Abiola et al., 2023; Neef et al., 2023). Also, in many supermarkets, designated packers are responsible for packaging consumers' goods and groceries during the checkout process. These packers typically make decisions on behalf of the consumers, including determining the number of plastic bags to use for the items. Consequently, many consumers become accustomed to having someone else, namely the assigned packers, handle the bagging process for them. As a result, individuals may not be fully aware of the quantity of plastic being employed in the packaging of their goods, as this responsibility is often delegated to the packers.

A survey conducted in South Africa reported that the majority of people do not reuse plastic carrier bags for shopping (Dikgang et al., 2012a). Instead, they tend to buy new bags with each visit to the supermarket. One reason for this is the inconvenience of bringing bags from the household to the supermarket or shopping center, as stated by the respondents. Those who reuse their plastic bags stated that this is typically for other household services, such as rubbish bags, which consequently end up being mismanaged or disposed of at city waste dumps (Dikgang et al., 2012a). Besides convenience, other reasons stated for buying and using plastic carrier bags are their easy availability and affordability (O'Brien & Thondhlana, 2019).

In recent years, one of the largest grocery retailers has introduced a thicker bag intended for reuse. Other stores also offer various reusable bags made from polypropylene (PP), polyester and polyethylene terephthalate (PET) or recycled PET (rPET) (Stafford et al., 2022). Bio-plastic bags are also being introduced in some grocery stores. Alongside the introduction of more sustainable and environmentally friendly packaging, promoting pro-environmental behavior, such as recycling, reusing and using alternatives, might be an

effective intervention for education and source reduction (O'Brien & Thondhlana, 2019). The introduction of bio-plastic bags and other more sustainable options, however, can trigger what is known as rebound effects, as consumers may perceive them as environmentally friendly, potentially overlooking their actual environmental impacts. However, plastic carrier bag consumption has become a habitual behavior, which then again is challenging to change without the intention and awareness of acting in a pro-environmental way.

A Psychological Approach to Understanding Plastic Pollution

Psychological Predictors of Behavior

Behavior includes everything we say and do – our actions, body language, facial expressions, speech, and more. It also includes events that only the person in question can experience, such as bodily reactions (Karlsen & Isaksen, 2018; Kennair, 2022; Pierce & Cheney, 2013). In other words, it pertains to all possible forms of activities and responses we can exhibit, both those observable and those invisible to others. Behavior is fundamentally a manifestation of our actions, which includes conscious and deliberate bodily movements, but could also be mental behavior, e.g. purposeful thought processes we undergo. This means that individuals' inner reflections and decision-making processes can be considered a form of behavior. Some will also include automatic processes, like habits and rituals, as a form of behavior (Kennair, 2022). Even though these appear to be reactions that run on autopilot, they are a part of how we act, and therefore, a part of our behavior. Human behavior can therefore be seen as a diverse concept that defines our way of being and interacting with the world around us.

How individuals perceive their own behavior regarding plastic consumption, including their attitudes, beliefs, and intentions, may be influenced by numerous factors such as social pressure, personal values, environmental awareness, and the availability of other alternatives. According to a study by Hammami et al. (2017), awareness of harmful effects of plastic had no significant impact on behavior. In another study, O'Brien and Thondhlana (2019) asked

residents in South Africa to categorize their plastic bag usage practices. Less than half of the respondents claimed to primarily use reusable shopping bags, however, they admitted to purchasing plastic carrier bags if they forgot their reusable ones at home.

In other words, many behaviors become ingrained within daily routines, performed automatically without conscious though, forming learned habits that contribute to behavior complexity. With numerous daily decisions, it's impossible to be aware of every isolated behavior. Effective behavior change involves altering surrounding routines rather than individual acts, acknowledging their interconnectedness and the pivotal role of modifying the environment (Heimlich & Ardoin, 2008). This approach optimizes effectiveness by considering target behaviors, identifying barriers and benefits, and employing specific tools (McKenzie-Mohr & Schultz, 2014).

From a psychological perspective, behavior is influenced by various factors beyond current circumstances and individual knowledge. Predictors of behavior, ranging across contexts and disciplines, encompass attitudes, beliefs, values, social norms, personality traits, and perceived behavioral control (e.g., Carmi et al., 2015; Luchs & Mooradian, 2012; Stern, 2000). These factors shape individual actions or choices, presenting opportunities, constraints, or cues for certain behaviors (Fiske, 2018). Situational and psychological factors crucially shape the use of plastic bags and environmentally friendly alternatives, identified by various drivers and barriers impacting intended and observable plastic bag behavior. Despite widespread knowledge of plastic's negative impact, additional factors like ingrained habits, social norms, values, and intentions influence behavior. Effective behavior change requires more than education; it necessitates addressing these underlying factors to foster sustainable actions and mitigate plastic pollution. By examining the behavioral predictors, like self-reported actions, habits, and intentions, we can gain deeper insights into people's plastic bag consumption patterns. The following section will outline fundamental psychological

predictors associated with environmental behavior, providing examples from previous studies examining these aspects.

Habits and Environmental Behavior

Habits are recurring, often automatic actions or routines that profoundly influence our daily lives and are defined by Klöckner & Verplanken (2018) as "cognitive structures that automatically determine future behavior by linking specific situational cues to chains of behavioral patterns". They can be considered fundamental elements of human behavior, shaping our actions and responses, often unconsciously, impacting our ability to achieve goals. From simple tasks, like brushing teeth, to complex activities like regular exercise, habits vary widely (Klöckner & Verplanken, 2018; Verplanken, 2018). Formed through repetition and reinforcement, habits become automatic responses when successfully performed, achieving its intended goals and desired outcomes (Linder et al., 2021; Kurz et al., 2015). Initially influenced by intention, consistent repetition strengthens habits over time, surpassing the impact of intentions (Linder et al., 2021; Klöckner & Verplanken, 2018).

While most habits serve underlying goals, whether it be practical or hedonistic, not all successful, repeated behaviors within stable contexts qualify as habits, and their functionality does not always guarantee benefit (Verplanken, 2018). Our brains, in their quest for efficiency, create neural pathways that make it easier to repeat that action in the future. This habitual pattern, referred to as the 'habit loop', consist of three components: cue, response, and reward (Chen et al., 2020). The cue triggers the response, prompted by internal or external stimuli like time of the day or emotional state. This response, the behavior itself, can be simple or complex. The reward is the positive outcome or satisfaction that we gain from the completed response reinforces the loop, increasing the likelihood of future behavior repetition. As habit loops repeat, they form strong neural connections in the brain, associating the cue with the desired behavior and its corresponding reward (Verplanken & Orbell, 2003;

Wood & Rünger, 2016). Over time, this repetition leads to the automatic, subconscious execution of the habit. The brain becomes highly efficient at executing these routines, conserving cognitive capacity for other tasks, and is 'wired' to respond automatically to specific triggers with habitual behaviors. Habits could therefore be considered as a product of our neural networks 'remembering' recurring contexts and the optimal responses associated with those contexts (Verplanken, 2018).

Habits are proven to be one of the strongest predictors of environmental behavior, that is actions that affect resource and energy availability, impacting ecosystem's structure and function (Gatersleben, 2019). These actions encompass both those that have adverse environmental effects and those promoting environmental well-being, this includes almost all kinds of behavior, as most human activity has some sort of environmental impact. An increasing interest within environmental psychology revolves around finding ways to alter people's behavior to reverse environmental issues, all while safeguarding human well-being and quality of life (Steg & de Groot, 2019). Change of behavior is necessary to improve the worlds environmental situation. This type of behavior refers to what is known as pro-environmental behavior, including actions, choices, and practices that minimize the negative impact on the environment and promote the well-being of the planet (Gatersleben, 2019). These behaviors aim to reduce resource consumption, minimizing pollution and waste, and support the conservation and sustainable use of natural resources (Tian & Liu, 2022). Researchers argue that acting pro-environmental is necessary to ensure the well-being on both an individual and societal level, with individual changes as preconditions for societal changes as well (Kukowski et al., 2023).

A study by Pothitou and colleagues (2016) found that UK residents who holds more positive environmental values and greater environmental knowledge are more likely to express energy behaviors, attitudes and habits that leads to energy saving activities. Recycling

is another pro environmental behavior that requires effort through several steps (Mullan & Novoradovskaya, 2018), but also does not exhibit the immediate positive environmental effects. Holland, Aarts, and Langendam (2006) conducted an intervention study where the multistep recycling behavior was transformed into a one-step behavior by removing some of the crucial steps involved in recycling, e.g., the preparation (cleaning the material etc.) and decision making (throwing in a suitable bin). The study consequently shows that context modification and specific plans both assist in breaking habits of non-recycling and creating new ones of recycling.

Human behavior significantly contribute to many of the current environmental challenges. Achieving shared sustainability goals and preserving the Earth's well-being require behavior change at all levels, from individuals to societal leaders (Verplanken, 2018; Linder et al., 2021). One plausible explanation for the struggles in achieving these objectives and for individuals facing challenges in transitioning to a more environmentally friendly lifestyle, may be the deeply entrenched nature of their current habits, which often override new knowledge and intentions (Linder et al., 2021).

Habits and Plastic Consumption

In the context of plastic consumption, habits have been shown to strongly influence consumption (Heidbreder et al., 2019; Makarchev et al., 2022). A recent study by Abiola and colleagues (2023) revealed that the purchase of plastic bags has become a habitual behavior among customers in supermarkets. Despite the availability of alternatives and campaigns to discourage the use of single use plastic bags, the habitual behavior persists even when there is a monetary cost or levy associated with it. However, the intervention study found that non-monetary interventions were more effective in promoting the use of reusable bags than monetary interventions, indicating that plastic bag consumption is strongly habitual, especially in South Africa.

According to a study on plastic consumption in Vietnam (Makarchev et al., 2022), habits was recognized as a significant predictor with by far the greatest effect on plastic bag consume, along anti-plastic bag reminders from retailers. The anti-plastic bag movement in Vietnam is still in its early stages and the idea of not using plastic bags is not commonly suggested, as well as it is few available alternatives. Assumingly, this has led to the formation of strong habits among people, making it challenging to change their behavior regarding the use of plastic bags. While acknowledging several disadvantages of plastic bags, e.g., flooding caused by plastic bags clogging ditches and drainages, air and soil pollution, as well as easily tearing and being unhygienic, the consumption of plastic bags are claimed to "be normal" and has "just become a habit" in a number of societies (Spranz & Schlüter, 2023, p. 327).

Another study by Heidbreder et al. (2020) found that habits are strong predictors of plastic consumption, but do not predict policy support. In this intervention study, information on the negative impact of single use plastic and advice on how to reduce plastic consumption were presented. However, the study suggests that when performing habitual behavior, information can be suppressed if it does not align with an individual's habits. Therefore, solely informing people about the problem is unlikely to change their habitual behavior.

Even when people are willing to reduce their plastic bag consumption, the habit of purchasing single use plastic bags seem to overpower the intentions of bringing one's own bag (Bartolotta & Hardy, 2018; Zen et al., 2013). The power of habits can explain why previous and existing initiatives on plastic bag reduction have had limited success (Makarchev et al., 2022). Initiatives focused on changing practices, but habits, which are more deeply ingrained and automatic, has not been effectively addressed. As habits are more resistant to change, efforts to reduce plastic bag usage need to consider strategies that go beyond changing practices and tackle the underlying habits that have formed.

Intentions

Intentions are defined as premeditated conscious decisions to engage in specific behaviors (APA Dictionary of Psychology, n.d.). They represent mental states that drive and guide our actions toward desired outcomes, often influenced by values, beliefs, and external factors such as social norms, cultural expectations, and circumstances (Ajzen, 1985; Malle et al., 2001). These intentions may encompass a variety of actions aimed at reducing one's plastic consumption in daily life, including using reusable bags, avoiding products with excessive packaging, and proper plastic disposal to prevent environmental contamination. Motivation to minimize plastic usage or enhance recycling efforts can stem from either extrinsic factors, such as monetary incentives, or intrinsic factors, where actions align with an individual's values and are perceived as meaningful (Jacobsen et al., 2022).

According to Ajzen's (1991) theory of planned behavior (TPB), intentions play a central role in predicting and understanding behavior. Intentions is again determined by the three constructs attitude, subjective norms, and perceived behavioral control. Thus, while intentions directly predict behavior, they may not account for the entire range of variance in behavior. In a study on environmental behavior in workplaces, the TBP constructs was found to account for a significant percentage of the variance in employees' intentions on environmental behavior, such as energy saving, traveling, and recycling (Greaves et al., 2013). Similarly, Liu et al. (2020) found that peoples environmental behavioral intentions have a significant positive effect on their pro-environmental behaviors.

The Relationship Between Habits and Intentions

Habits and intentions are both powerful drivers of behavior, operating through different systems. Habits, being automated and unconscious, are often defined in contrast with reasoned, deliberative concepts such as intentions (Gardner et al., 2015). Representing different pathways to action, habits and intentions can work interactively to support our goals.

Numerous studies have explored the relationship between habits and intentions. For example, Danner et al. (2008) found that habits interacted with intentions when context stability was taken into account, but not when only the frequency of past behavior was considered. Researchers suggest that intentions guide future behavior when habits are weak, and that intentions are less predictive of behavior when habit is strong. These findings underscore the importance of the context of behavior in understanding the role of habits in intention-behavior relationships (Danner et al., 2008). Studies also suggest that habits and intentions can clash or block each other out in certain situations. It is theorized that when habits and intentions conflict, the automatic pathway will generate habitual behavior more rapidly than the conscious pathway can initiate counter-habitual intentions (Gardner et al., 2015). As a result, habits are widely believed to moderate the relationship between intention and behavior.

Additional Predictors of Plastic Bag Consumption

The usage of plastic bags can be influenced by various predictors, encompassing individual, social, and environmental factors. Common predictors including social norms, convenience, financial aspects and more will be discussed below.

Social Norms. Social norms play a central role in predicting plastic consumption, shaping perceptions of what is considered acceptable and appropriate within a community. Several studies emphasize the influence of social norms on individual's plastic consumption behavior, particularly concerning the impact of social desirability. Arı and Yılmaz (2017) revealed that social norms significantly impact the willingness of individuals to choose cloth bags over plastic bags, as their choices are guided by subjective norms prevalent in their communities, specifically descriptive social norms. Similarly, Cherrier (2006) demonstrated that individuals struggle with feelings of guilt and fear of judgement from other customers when accepting plastic bags at the counter, reflecting injunctive social norms. This ingrained social norm favoring the use of plastic bags contributes to their widespread adoption, even in

the face of environmental concerns, as people tend to litter more in environments already littered, as highlighted by Farage et al. (2021).

Convenience. Plastic bags are commonly preferred for their convenience, lightweight, and durability, along with functional attributes like hygiene and protection (Heidbreder et al., 2019). Additionally, their low cost adds to their appeal, as indicated by insights from semi-structured interviews with Kenyan respondents (Otsyina et al., 2018). Convenience emerges as a more influential factor in explaining variance than the core variables of the theory of planned behavior (TPB; Ajzen, 1991) when it comes to the intention of using plastic bags (Sun et al., 2017). This observation aligns with the TPB's primary functionality for conscious choices rather than habitual behaviors. Structural alternatives such as zero-packaging stores were perceived as inconvenient, potentially contributing to the continued attractiveness of single-use plastic bags (Beitzen-Heineke et al., 2017).

Cost. Several governments globally have initiated measures to reduce plastic bag usage, often through levies, taxes, or fees (Dikgang et al., 2012b; Gupta, 2011; Rivers et al., 2017). The affordability of plastic bags relative to other, often more sustainable options contributes to high consumption rates (Adane & Muleta, 2011; Dikgang et al., 2012b). The efficacy of financial barriers in instigating changes in consumer behavior solely through levies is a matter of scrutiny, as consumers tend to adapt to such measures over time (Dikgang et al., 2012a). Consequently, a combination of financial incentives and other interventions may be needed to achieve significant and lasting impacts. Abiola et al. (2023) even proposes that non-monetary interventions might be more effective in reducing plastic bag consumption than monetary measures, such as distributing reusable bags for free or providing subsidies on reusable bags.

Perceived Behavioral Control. Perceived behavioral control involves the perception an individual has of available behavioral options and confidence in their capabilities.

Substitutes for plastic bags includes various choices, including paper bags, cotton bags, and alternative behaviors like using a cardboard box or carrying groceries without any carrier. In their meta-analysis, Heidbreder et al. (2019) suggest that people often perceive limited alternatives to plastic bag usage. Likewise, in Avallone et al.'s (2012) study, the primary reason for using plastic bags was the perceived lack of alternative options and confusion about their environmental impact. Therefore, it is crucial not only to present consumers with alternative choices to single-use plastic bags but also to provide information about environmental consequences associated with these alternatives.

Problem Awareness. Plastic mainly used in packaging and bags is commonly perceived as an environmental concern (Adane & Muleta, 2011; Otsyina et al., 2018). Discussions in social media often associate plastic with terms like sustainability and waste, reflecting a heightened awareness of the problem (Richardson et al., 2016). While an earlier Danish study downplayed environmental issues related to packaging waste (Bech-Larsen, 1996), recent large-scale surveys conducted in various countries (e.g., Portugal, UK, Germany and Canada) indicate a shift in perception. Pollution, especially plastic waste, is now widely acknowledged as a major environmental problem (Gelcich et al., 2014; Hartley et al., 2018b; Lotze et al., 2018). The extensive use of plastic, particularly in packaging, is recognized as a significant contributor to pollution. However, some studies have shown that participants considered these issues less pressing than other environmental problems (Anderson et al., 2016).

Note that there are other predictors of plastic bag consumption that could have been included, but that the researcher chose not to, for example attitudes, contextual factors, diffusion of responsibility, personal norms and identity, and other socioeconomic factors such as income and employment (e.g., Heidbreder et al, 2019, 2020).

Theoretical Framework and Models

While socio-cognitive models (e.g., *the theory of planned behavior, value-belief-norm theory, theory of reasoned action*) are widely used to predict environmental behavior, their focus on portraying behavior as intentional falls short in explaining habitual behaviors (Verplanken & Whitmarsh, 2021). Many (non-)environmental behaviors are habitual and recurring in unchanging settings, such as recycling, consumption, and transportation choices. In this section, theoretical frameworks that can contribute to the explanation and understanding of habits in environmental behavior will be discussed.

The Habit Discontinuity Hypothesis

The habit discontinuity hypothesis by Verplanken et al. (2008) posits that interventions targeting behavior change are most effective when introduced during life course changes. The rationale behind this assumption lies in the idea that when habit face temporary disruption, individuals become more receptive to new information and adopt a mindset conducive to behavior change. Despite expressing concerns and pro-environmental attitudes when questioned, people often rank the environment low among today's most important issues, making promoting environmentally friendly behaviors particularly challenging (Verplanken & Roy, 2013; 2016). Many behaviors targeted for more sustainable directions, such as transportation, leisure activities, shopping, or water usage, tend to be ingrained habits, conducted regularly at the same time and location, and are less guided by conscious intent. Habits comes with a degree of 'tunnel vision', characterized by a lack of choice awareness, superficial decision making, and little interest in new information, even when asked to make deliberate decisions (Verplanken & Roy, 2016), hindering efforts to change them and posing challenges for behavior change interventions.

However, changes in context or other circumstances may temporarily disrupt habits and require alternative actions, creating a *window of opportunity* which can be used to

promote behavior change (Heidbreder & Schmitt, 2020). The window of opportunity refers to a limited time period which the modification or change of a particular action is optimal or most likely to succeed. Studies (e.g., Fujii et al., 2001;Verplanken et al., 2008) suggest that major life course changes (e.g., career change), geographical or other physical shifts (e.g., moving cities), or alterations in the environment (e.g., urban development) where habits occur can force individuals to reevaluate their behaviors, necessitating new choices and fostering a mindset open to change or break a habit (Verplanken & Roy, 2016). Habit literature indicates that reconsidering and altering frequently performed behaviors in stable contexts is unlikely unless there is a disruption, making behavior change interventions more effective when disrupting habits. Additionally, context changes can emphasize behavior-relevant information, prompting new choices and decisions (Verplanken et al., 2008).

In an intervention study targeting 800 households to promote sustainable behaviors, it was discovered that behavior change was significantly more likely among participants who had recently moved houses, compared to non-movers and those in a non-intervention control group, with the observed window of opportunity for increased receptivity to behavior change persisted for up to three month following the relocation (Verplanken & Roy, 2016).

The Dual Process Model

The dual process model is a theoretical framework proposing two distinctive modes of information processing or decision making: the automatic, or intuitive, and the controlled, or reflective, system (Samson & Voyer, 2012). The automatic system operates fast, effortlessly, and intuitively, functioning automatically without conscious awareness. It is responsible for rapid, heuristic-based judgments and responses, relying on mental shortcuts and associations developed through prior experiences. On the other hand, the controlled system operates at a slower pace, requiring effortful and deliberate processing. It involves conscious awareness

and reasoning, engaging in more complex cognitive tasks and systematic information processing.

The diverse forms of fast, automatic learning and retrieval capacities in these models are categorized in terms like system 1 and the impulsive system (e.g., Kahneman, 2002; Strack & Deutsch, 2004). This system includes habits, other aspects of automaticity, and low-effort processes, like relying on heuristic judgment rules (Wood et al., 2014). The dual process model is often employed in behavior change interventions. The automatic processes are assumed to drive habitual behaviors and can therefore be hard to change, while the controlled processes can be targeted in interventions to change attitudes and beliefs, promoting an intentional behavior change (Wood et al., 2014).

A dual process study by Ohtomo & Hirose (2007) on recycling behavior and norms in Japanese students revealed that the acceptance of environmentally unfriendly behavior is influenced by descriptive norms, indicating a reactive (automatic) decision-making process. On the other hand, the intentional promotion of environmentally friendly behavior is determined by environmental concern and the injunctive norm. The study suggests that the prominence of either the reactive, or automatic, or intentional, similar to the controlled system, process can either inhibit or promote environmental behavior. The interplay of these factors underscores the complexity of decision making in the realm of environmental actions.

Summary of the Preceding Study

This master's thesis builds upon a similar study that has been conducted on plastic bag consumption in South Africa in 2023. The aim is therefore to conduct a parallel study in Norway in order to identify any similarities and differences in plastic bag behavior among consumers in different nations. To understand the design of the data collection conducted in the master's project, it is crucial to get an overview over the study conducted in South Africa.

Funded by Handelens Miljøfond, the research project "The human dimension of plastic pollution in South Africa: building capacity to understand and change behavioral drivers and barriers" examines the determinants of plastic bag consumption in South African supermarkets, employing a multi-method approach, including survey questionnaires and behavioral observations (See Appendix C for further information). The data collection involved 568 survey respondents and 322 in-store observations in Potchefstroom, South Africa. The data collection was conducted in the period spanning from November 23rd to December 3rd, 2022, in two grocery stores. The two stores are situated in close proximity, located across from each other within two shopping centers, and belonging to the same chain. The surveys were administered manually by hand. Two assistants conducted the observations simultaneously, both observing the same customer.

Survey results highlight the impact of social norms, habitual behavior, perceived behavioral control, intentions to reduce plastic pollution, and perceived convenience on reusable bag use. Interestingly, financial constraints and government regulations regarding bag recyclability show less impact on self-reported behavior. Social norms emerge as the most influential predictor among these factors. However, a significant disparity between self-reported behaviors and observed rates of reusable bag adoption (15.8%) underscores discrepancies.

The study also reveals the effectiveness of behavioral nudges, such as not giving plastic bags unless a customer specifically asks for one, in influencing plastic bag acquisition rates. Based on these findings, the researchers recommend interventions that align descriptive and injunctive norms, prompt habit modification through reminders, and educate consumers about the environmental impact of alternatives in an accessible manner. The implications of this study extend beyond South Africa, offering insights for global regions dealing with similar challenges and providing valuable input for policy and practice.

The Current Study

In light of the environmental threat posed by the extensive use of plastic bags, this study aims to investigate individuals' habitual behavior of the consumption of plastic bags and explore variations in behavioral patterns among consumers in Trondheim, Norway. Finally, there will be a comparison with the results of the research conducted in South Africa. The research questions guiding this investigation are as follows: 1) How do habits, along with intentions, social norms, cost, convenience, conformity, perceived behavioral control, and demographic variables, predict individuals self-reported plastic bag behavior? 2) What is the prevalence of bringing reusable bags versus purchasing plastic bags at grocery stores, and how do demographic variables affect these behaviors according to observational data? And 3) What differences exist in the behavioral patterns in plastic bag consumption in Norway and South Africa?

By addressing these aspects, the research aims to contribute to a comprehensive understanding of plastic bag consumption habits, intentions, and behavior. The study will employ a mixed-methods approach, including surveys and observations to capture the nature of these behaviors and habits.

Method

The research project's aim, purpose and hypothesis were decisive for the choice of methods. Given that the study is an extension of a previously conducted research in another country, it is only natural to employ the same data collection methods. Opting for a quantitative approach allows for information gathering from a larger sample. In the present study, a combination of observations and survey were chosen. Surveys offer the advantage of facilitating the collection of a large sample while being both time and cost-effective. Findings from surveys are also generalizable to the population of interest. To obtain an appropriate sample size suitable for the planned analysis and sufficiently representative of individuals

within the target population, conducting a survey investigation is highly practical. The study was designed in a manner that ensures the participants' anonymity, and thus no information can be traced back to individuals. Additionally, hidden, naturalistic observations were conducted in checkout settings (i.e. the final stage of the shopping process where customers pay for their selected items with the assistance of the cashier) at local grocery stores to gain insight into specific situations and behaviors. These observations were designed to be discreet, ensuring the anonymity of individuals observed, as the behavior occurred in public settings. By observing customers, the study aims to establish whether reported behavior aligns with observed actions. Please note that the survey participants and the observed customers are not identical, but as they stem from the same target population, we can assume that the results are both relevant and can be combined in one study.

The survey was conducted to explore the predictors of plastic bag use in everyday grocery shopping, drawing upon insights from previous research on the subject. It aimed to explore individual's self-reported behaviors related to plastic bag usage, along with capturing their perspectives on their habits. The observations were done to examine people's behaviors around plastic bag usage in stores, seeking to identify any disparities between their self-reported actions and their actual behavior. The components of the research are briefly discussed in the following sections.

Approach, Strategy and Method

Research approaches are broadly divided into inductive and deductive approaches. This study will be taking a deductive approach, as it draws inferences from analyzed data, with the objective of generalizing research findings to a broader population.

This study employs a mixed methods approach for data collection in order to address the research questions. Consequently, a survey was conducted alongside hidden, naturalistic observations. The survey was conducted through the Norwegian data collection service InFact

in November 2023. The methodology involved telephone interviews as the primary means of gathering information. It was also strategically focused within a limited geographical area, the city of Trondheim, Norway, ensuring a targeted and specific dataset. The observations were conducted in the period of December 12 to December 15, 2023, in one grocery store by a researcher and a research assistant.

Target Population and Sampling Procedure

The target population for this study was consumers aged 18 years and above, residing in the city of Trondheim, Norway, who regularly shop in physical grocery stores. People who do grocery shopping through online services, e.g., *Oda (https://oda.com/no/)*, were therefore not included in the study. The population is assumed to cover a variety of income profiles, educational backgrounds, and life situations (e.g., retirement, student, etc.). The observations took place in one grocery store, Rema 1000 Moholt, located southeast in Trondheim. Rema 1000 is the second largest grocery chain in Norway and are widespread in Trondheim, placed nearby large student housings and well-established neighborhoods. The proximity of the grocery store to student housing units may influence the overall customer demographic, reflecting the backgrounds or life situations of nearby residents. However, the store is considered one of the cheaper stores and should therefore be attracting a range of income profiles.

In Norway, the cost of standard single-use plastic bags in grocery stores is currently 4.25 NOK (0.41 USD). Rema 1000, like most other stores, offers a reusable bag made out of 100% recycled polyester. The price for reusable bags varies across stores; at Rema 1000 the reusable bags cost 10 NOK each (0.96 USD). Rema 1000 do not offer paper bags anymore because “(…) the plastic bag is a better alternative than paper bags when it comes to the impact they have on the environment”. (Rema 1000, n.d.). Most stores in Norway also offer boxes (used in transportation etc.) for free on request from the customer, but this is not a

common way to pack groceries. Also, they are not always available, for example if they have already been thrown away by the store employees.

In terms of sample size, a large *N* increases the probability that the sample and responses are highly representative of the population. In the current study, specific target numbers were not pre-established for either the survey or observation samples; instead, they were determined by the prevailing circumstances. Regarding the sampling method, it corresponds to convenience sampling, wherein subjects are selected based on their easy accessibility and proximity. The method is often used for its efficiency, especially in situations where time, resources, or accessibility to a target population are limited. The data collection service was expected to provide a minimum of 400 complete surveys. However, the survey ended up receiving responses from 540 participants in Trondheim, Norway, comprising 254 females and 286 males, with ages ranging from 18 to >70. For the survey sample, no one identified as non-binary or any other gender identities, and the thesis will therefore only be using the categories of 'male' and 'female'. 285 observations were made in a local grocery store, encompassing a diverse demographic including students, elders, and families with children. Among these, there were 127 females and 158 males, with an estimated 146 individuals falling within the age bracket of 18-40, and 139 are presumed to be 40 or older. For the observations, the researcher categorized the observed individuals into the two gender groups, though being aware that they could have been non-binary or identify as any other gender identity.

Survey

Construction of Measurement Instrument

Survey data were collected using a self-administered questionnaire (see Appendix A), divided into two sections. Section A covered questions regarding the demographic profile of

the consumers. Section B encompasses the identified predictors of behavior and measures of the target behavior itself.

The survey questions in the current study leaned on a survey conducted in South Africa. For the South African study, pre-established scales were selected based on prior literature (e.g., Ajzen, 1991; Heidbreder et al., 2019; Verplanken and Orbell, 2003) and adapted to the context and assessed by stakeholders in South Africa. The items were pre-tested on a smaller sample of respondents in South Africa to develop a satisfactory measuring instrument. For the replication in Norway, the survey was translated and adapted to a Norwegian context, where questions were either removed or rephrased due to their relevance to the Norwegian population. This led to the removal of questions such as "It is better to layer several bags when packing heavy items" and "From the year 2027 all plastic bags in South Africa must be made of 100% recycled material. I am convinced that these types of recycled plastic bags will reduce plastic pollution". Due to the recent increase in the cost of plastic bags in Norway, we added the item "I have reduced my usage of plastic bags in grocery stores as a result of the recent price increase, compared to my use of plastic bags before the price increase". The Norwegian version of the survey underwent testing on a smaller sample in a pilot study, with an emphasis on clarity and duration.

When designing a questionnaire, several considerations must be taken into account. Among these considerations are how respondents will interpret and comprehend the questions posed, as well as how the instrument used can influence their responses (Schwarz et al., 2008). To elicit responses that are as meaningful as possible, respondents must grasp what is relevant to the research and be able to communicate this information in an informative, truthful, and clear manner. The formulation of questions and statements in the survey will influence how respondents interpret the question and their perception of what is significant in the given context. In consideration of these recommendations, a pilot survey was conducted

after translating the survey from English to Norwegian to ensure that the translation was satisfactory and that there were no unclear or ambiguous aspects and the terms used. When the question concerns a specific behavior, respondents need to recall relevant episodes. Unless the behavior is infrequent and important, this can become a challenging task and respondents will need to rely on inference and estimation strategies to answer (Schwarz et al., 2008). Grocery shopping is something most people typically do on a weekly basis, and therefore it is not unlikely that one holds clear thoughts about their typical action pattern.

Section A

Demographics. The first section in the study includes demographics, measured through the following questions: gender, age and level of education. Demographic variables such as gender, age and education provide basic information about the characteristics of the sample and help describe both the composition and the distribution of participants. They also help identify general group differences which can be useful for investigating different behaviors while keeping the participants anonymous. Demographic variables may also serve as covariates or control variables in statistical analyses. All information is processed anonymously and will provide an insight in how representative the study is. The more diverse the participants are, the more meaningful the results will be, as it enhance the representativeness, validity, and relevance of the study's findings.

Section B.

The following section in the survey includes various items concerning the respondent's thoughts on their daily or weekly habits, norms, convenience, levies, alternative options, recent behavior and intentions associated with one's consumption of single-use plastic carrier bags. These are all factors identified through previous studies as predictors of plastic bag use. All responses in the following section were captured using a 7-point Likert

scale ranging from 1 (strongly disagree) to 7 (strongly agree), indicating participants level of agreement with the statements.

Habits. Habits are measured using selected items from the Self-Report Habit Index (SRHI). The Self-Report Habit Index by Verplanken and Orbell (2003) was developed to measure habit strength that is based on four distinct and independent features an automatic process might be characterized by. These are unintentionally, uncontrollability, lack of awareness, and efficiency (Bargh, 1994, 1996). Verplanken and Orbell (2003) assumed that uncontrollability, lack of awareness and efficiency would be features that characterize the experience of habits in everyday life. The SRHI therefore contains 12 items and measures habit strength by breaking it down into the various features of habit: repetition, automaticity and identity expression.

An item measuring a habit could be "Choosing a plastic bag at the store to carry my groceries is something that I do …". To measure the latent construct of the habit in question, different items measuring different dimensions of the habit construct was utilized. These dimensions were 'automatically', 'without remembering', 'without thinking', and 'before I realize I'm doing it'.

Social Norms. Social norms can be defined as 'a predominant behavioral pattern within a group, supported by a shared understanding of acceptable actions and sustained through social interactions within that group' (Nyborg et al., 2016). For the survey, three items were used to measure social norms, adapted from Ajzen's (1991) subjective norms in the TPB, considering people whom one values opinions and actions. Social norms could be measured through items like "Most people who are important to me expect me to avoid using single-use plastic bags."

Perceived Behavioral Control. Perceived behavioral control, also called self-efficacy, refers to an individual's subjective perception of their capability to successfully execute specific tasks or achieve desired results (APA Dictionary of Psychology, n.d.). It is recognized as a determinant of motivational states and behavioral change and has an impact on an individual's effort invested in the pursuit of their goals. Considering plastic bag behavior, this could be measured through the item "I choose single-use plastic bags because I do not have or know of any other options."

Convenience. The item on perceived convenience measures whether or not one finds it practical to purchase plastic bags. This refers to the judgment of how easy a particular task or process is, and could include factors such as ease of use, accessibility and availability. An item measuring convenience in regards of plastic bag usage could be "Using single-use plastic bags for shopping is the most convenient option."

Conformity. People may hesitate to express their own opinions or actions because they don't want to stand out or are afraid of being judged by others. Saying no may be perceived as going against social norms, and individuals may fear disapproval from others (Fiske, 2018). An example of conformity measured in the questionnaire could be "I feel uncomfortable saying no to single-use plastic bags at the till because no one else does it."

Cost. In Norway, there was recently an increase in the plastic bag levy in grocery stores from 3 NOK (USD 0.29) to 4,25 NOK (USD 0.41). Therefore, the survey included two items regarding individual's choice of not purchasing bags due to their pricing and whether one reduced one's consumption after the increase in price. An example of one such item is "I do not use single-use plastic bags because I have to pay for them".

Intentions. Intentions are thought to capture the motivational factors that influence a behavior and serve as indications of how hard people are willing to try and how much effort

they are planning to exert to perform the behavior (Ajzen, 1991). The survey includes four items on individuals' willingness to reduce their personal consumption of plastic bags, to bring their own bags when shopping, to support policy regulations, and to support local initiatives that work to reduce the use of plastic bags. This could for example be "I am willing to do my best to reduce my personal consumption of plastic carrier bags."

Self-Reported Plastic Bag Behavior. Four items on self-reported behavior give individuals the opportunity to provide information about their plastic bag behavior the last four weeks. An example of the plastic bag behavior measured in the questionnaire could be "In the last 4 weeks I reused single-use plastic bags from the supermarket at home (e.g., as garbage bags)."

Observations

Observations were conducted at Rema 1000 Moholt in the period of December 12 to December 15 by two observers per customer. The purpose of having two observations of the same customer was to ensure the inter-observer reliability, which refers to the degree to which different observers give consistent estimates of the same phenomenon (Caro et al., 1979). The observations can be categorized as natural and non-intrusive, as the observers were not interacting with the cashier nor the customer.

Behavioral observation sheets (see Appendix B) were used to assess the plastic bag behavior of customer, as well as the interaction between the cashier and customer. The sheet first asks for the customer's assumed gender (male or female) and estimated age (18-40 or 40 and above), followed by a mapping of the interaction between the cashier and customer. This includes whether the cashier offers or ask if the customer need a bag, whether the cashier scans the goods without asking anything, and whether the customer accepts one or more bags or not. Following, the customers' packing behavior was observed, including how many bags

were purchased and what type, whether they brought their own and what type, or if they chose not to purchase or bring their own, i.e. carrying the goods in their hands.

Reliability and Validity

Reliability. Reliability assesses the degree of precision of a measurement instrument. That is, the extent to which an instrument is free from random measurement error and can be considered reliable and stable. In this study, the reliability was checked in accordance with internal consistency. Internal consistency indicates whether the individual items on a multi-item test correlate with one another and therefore are likely to measure the same underlying construct using Cronbach's alpha (α) (Meltzoff & Cooper, 2018). Cronbach's alpha estimates the reliability on a scale between 0 and 1. In most cases, an α-value of ≥.70 is considered an acceptable value (Mehmetoglu & Jakobsen, 2022). Values under .70, but closer to .50 could be tolerated as latent variables that observe psychological phenomena due to the construct's diversity (Kline, 2011), meaning that lower values could be considered acceptable because they reflect the complexity of psychological phenomena such as human behavior. See table 2 for α values.

Validity. Validity refers to the degree to which an instrument accurately measures what it is intended to measure and ensures that the data collected is relevant and meaningful for addressing the research questions. In order to enhance the validity of this study, content validity and discriminant validity were tested for the survey. Content validity refers to the extent to which a measurement instrument covers the entire range of the construct it is designed to measure, e.g., ensuring that the questions address various aspects of the phenomenon you wish to investigate. Content validity is ensured by clearly defining the construct or concept under investigation, for instance, through the utilization of a theoretical framework and reviewing existing literature, followed by a piloting the survey. Discriminant validity, which is a part of construct validity, evaluates whether a measurement instrument is

able to distinguish between the construct it is designed to measure and other unrelated constructs. To check for discriminant validity, a correlation analysis was done (see Appendix table D 1). As for the observations, validity is ensured by having two observants observing the same individuals simultaneously and comparing the results. Both reliability and validity are critical to ensure that the findings are trustworthy and meaningful.

Statistical Analyses

Survey Data

The survey dataset was received in Excel format and converted to STATA/MP 18 for the statistical analyses. Before the analyses were carried out, the data material was controlled to identify potential missing data. Participants who had an error margin of more than 25% (i.e., participants who answered less than 19 questions) were removed from the data set and excluded from the study. No significant outliers were identified. The remaining variables were then identified and formatted to the same measurement level.

After clearing the data material, new variable names were assigned for a more systematic analysis. Initially, descriptive analyses were conducted on demographic variables, and the distribution of values for the remaining variables was examined to gain an overview of data points. Subsequently, Cronbach's alpha values were assessed for the pertinent variables to examine the internal consistency (i.e., reliability). Scales were constructed for all constructs measured by more than one item. The statistical analyses conducted were descriptive statistics and various regression analyses.

Regression Analyses. Regression analyses examines the relationship between a continuous dependent variable and one or more continuous or categorical independent variables (Mehmetoglu & Jakobsen, 2022). Human behavior is a complex phenomenon that can be influenced by several factors. Therefore, it could be desirable to include more than one

independent variable to achieve a more complete picture of what we are studying. With multiple independent variables, it will also be possible to estimate the effect a factor has on the phenomenon by examining or controlling for other factors that may influence the phenomenon (Mehmetoglu & Jakobsen, 2022).

Heteroscedasticity is present in the regression analysis between items measuring intentions and habits, and behaviors and habits. The presence of heteroscedasticity can be due to measurement errors, model misspecifications or subpopulation differences (Mehmetoglu & Jakobsen, 2022). There are several consequences of heteroscedasticity, including that the OLS estimates are no longer giving the best linear unbiased estimator, and that the standard errors could be unreliable, which will cause bias in test results and confidence intervals. Heteroscedasticity should be corrected either by changing the functional form or by using a robust command in the regression analysis. To examine the variables heteroscedasticity, a White test and IM-test was performed. Later, a regression with the *vce(robust)* command was carried out in order to obtain robust standards errors.

Observation Data

The two separate sets of observation data from each observant was first compared by the researcher, where the observations that did not match each other were excluded from the study. The dataset was then manually coded in Excel and converted to STATA/MP (version 18) for analyses. The statistical analysis conducted was a ridge regression.

Ridge Regression. Ridge regression is a technique to estimate the coefficients of multiple regression models when the independent variables are highly correlated (Hilt & Seegrist, 1977). It was developed as a possible solution for the imprecision observed in least square estimators when linear regression models contain multicollinear variables. By creating a ridge regression estimator for the model, more precise parameters are provided, often with

smaller variances and mean square errors compared to those obtained from least square estimators (Jolliffe, 2006).

Logistic regression models rely on several key assumptions. Firstly, the dependent variable must be binary for a binary logistic regression, as it is in this case. Secondly, observations should be independent; matched data can lead to bias. Thirdly, there should be minimal multicollinearity among independent variables, ensuring they aren't highly correlated. Lastly, while linearity between independent variables and log odds is assumed, it is not necessary for the variables themselves to be linearly related.

In our dataset, some of these assumptions were violated, necessitating adjustments. The presence of "perfect separation" in the data prompted the adaption of ridge regression as an alternative to the traditional logistic regression. Perfect separation occurs when the outcome variable completely separates a predictor variable, resulting in a perfect prediction by the model (GraphPad, n.d.; UCLA Statistical Consulting Group, n.d.). In other terms, it means that for a particular predictor, one outcome consistently occurs above a certain predictor value, while the other outcome consistently occurs below that value.

Results

Survey

Demographics. Through the survey, we have collected data on gender, age, and education. The sample of 540 participants comprised 254 females and 286 males, ages ranging from 18 to 90 years, with a mean age of 56.7 (*SD* = 16.43). Educational levels were categorized into "no formal education," "primary," "secondary," and "tertiary" levels. "Primary" refers to primary school education, "secondary" to secondary education, and "tertiary" to vocational school and higher education (i.e. college and university). See summary in table 1.

Table 1: Sample description of the survey study

Demographic variable	***n***	**%**
Gender		
Female	254	47.04
Male	286	52.96
Age		
18-29	40	7.41
30-39	52	9.63
40-49	79	14.63
50-59	119	22.04
60-69	120	22.22
> 70	130	24.07
M (SD)	*56.7* (16.43)	
Education		
No formal education	11	2.04
Primary education	23	4.26
Secondary education	163	30.19
Tertiary education	343	63.52
M (SD)	*3.6* (.67)	

Total *N*	**540**

Regression analysis. The descriptives of the predictors can be seen in table 2. For the multiple regression analyses, all models were checked for heteroscedasticity and adjusted with robust standard deviations.

Table 2: Mean, standard deviation and Cronbach's alpha for all variables included in the model

Variable	***M***	***SD***	α
Habits (4 items)	2.75	1.80	0.87
Social norms (3 items)	4.90	1.61	0.67
Behavior (4 items)	4.53	1.34	0.32
Intentions (4 items)	5.49	1.59	0.82
Cost (2 items)	4.47	1.98	0.63
Conformity (2 items)	1.66	1.46	0.76
Convenience	3.81	2.41	-
Perceived behavioral control	2.32	2.30	-

Several multiple regression analyses were conducted to examine the factors predicting various plastic bag behaviors. The behavior of interest in this study is "In the last 4 weeks I brought my own bags (cotton, paper, plastic etc.) for shopping", but all measured behaviors will be included as well as a summary of the results.

First, a multiple regression with the behavior "In the last 4 weeks I reused single-use plastic bags from the supermarket at home (e.g. as garbage bags)" as the dependent variable was run to test which factors predicts the certain behavior. The model was significant, $F(10, 512) = 2.28$, $p = .013$, $R^2 = .04$.

Results suggest that the cost of plastic bags has a significant positive effect on the behavior of reusing plastic bags at home, $\beta = .18$, $p = .001$, indicating that individuals who perceive a financial cost associated with using plastic bags are more likely to reuse their

plastic bags at home. The coefficient for age suggest a weak relationship between the age and the given behavior, though not to a significant level. Remaining factors do not significantly predict the behavior of reusing plastic bags at home. See table 3 for summary.

Table 3: Results of multiple regression with behavior of reusing plastic bags at home dependent variable.

Variable	**Estimate**	***Robust SE***	***t***	***p***
Intercept	4.89	.80	6.12	< .001
Habits	.06	.07	0.79	.431
Intentions	-.04	.08	-0.55	.586
Cost	.18***	.05	3.36	.001
Social norms	-.04	.08	-0.50	.616
Conformity	-.09	.07	-1.17	.243
Perceived behavioral control	.01	.05	0.25	.803
Convenience	.07	.05	1.37	.171
Age	.01	.01	1.90	.059
Gender	.03	.19	0.16	.872
Education	-.18	.14	-1.30	.194

Note. *** p < .001; ** p < .01; * p < .05

A multiple regression with the behavior “In the last 4 weeks I brought my own bags (cotton, paper, plastic etc.) for shopping” as the dependent variable was run to test which factors predicts the certain behavior. The model was significant, $F(10, 512) = 46.13$, $p < .001$, $R^2 = .45$.

The results suggest that habits were the strongest predictor for bringing one’s own bags when shopping, indicating that stronger habits can be associated with a lower likelihood of

bringing own bags, β = *-.43, p < .001*. Intentions to reduce plastic bag consumption, the cost of plastic bags, and social norms also has a significant influence on this behavior, though to a lesser extent than habits. Convenience also plays a role in discouraging the use of own bags, indicating that individuals find it more convenient to purchase plastic bags at the store than bringing one's own. Conformity and perceived behavior control, however, did not show significant associations with the given behavior. Demographic variables age, gender and education does not have a statistically significant impact on the likelihood of bringing own bags when shopping. See table 4 for summary.

Table 4: Results of multiple regression with behavior of bringing own bags when shopping as dependent variable

Variable	**Estimate**	***Robust SE***	***t***	***p***
Intercept	3.2	.70	4.60	< .001
Habits	-.43***	.06	2.67	< .001
Intentions	.31***	.07	4.61	< .001
Cost	.26***	.04	6.59	< .001
Social norms	.16**	.06	2.67	.008
Conformity	.04	.06	0.76	.445
Perceived behavioral control	.04	.04	0.99	.321
Convenience	-.11**	.04	-3.19	.002
Age	.01	.00	1.53	.126
Gender	-.16	.15	-1.06	.289
Education	-.08	.12	-0.65	.519

Note. *** p < .001; ** p < .01; * p < .05

A multiple regression with the behavior “In the last 4 weeks I actively advocated with my friends and family that we should all use fewer plastic bags” as the dependent variable was run to test which factors predicts the certain behavior. The model was significant, $F(10, 512) = 36.41$, $p < .001$, $R^2 = .29$.

The results suggest that intentions was the strongest predictor for actively advocating with friends and family that we should all use fewer plastic bags, indicating that individuals with stronger intentions to reduce plastic bag usage are more likely to engage in this behavior, $\beta = .45,\ p < .001$. Social norms and conformity show a significant positive effect on the behavior of actively advocating, suggesting that individuals who perceive stronger social norms and feel unease regarding plastic bag usage are more likely to advocate for reducing plastic bag consumption. Additionally, the convenience coefficient shows a significant negative effect, indicating that individuals who perceive reducing plastic bag usage as inconvenient are less likely to engage in advocacy behavior**.** Habits, cost, perceived behavioral control, as well as demographic variables age, gender, and education do not have significant effects on this behavior. See table 5 for summary.

Table 5: Results of multiple regression with behavior of actively advocating that we should all use fewer plastic bags as dependent variable.

Variable	**Estimate**	***Robust SE***	***t***	***p***
Intercept	.57	.69	0.82	.412
Habits	-.12	.06	-1.91	.057
Intentions	.45***	.07	6.74	< .001
Cost	.09	.05	1.87	.062
Social norms	.23***	.07	3.29	.001
Conformity	.23***	.06	3.52	< .001

Perceived behavioral control	-.01	.04	-0.29	.773
Convenience	-.10*	.05	-2.27	.024
Age	.00	.01	0.31	.758
Gender	-.13	.19	-0.67	.503
Education	-.20	.12	-1.64	.101

Note. *** p < .001; ** p < .01; * p < .05

A multiple regression with the behavior "In the last 4 weeks, when I saw plastic bags on the ground, I picked them up and threw them in the nearest trash bin" as the dependent variable was run to test which factors predicts the behavior. The model was significant, $F(10, 512) = 2.31$, $p = .011$, $R^2 = .04$.

The results suggest that intentions was the strongest predictor for picking up and throwing plastic bags in the bin, indicating that individuals with stronger intentions to reduce plastic bag usage are more likely to engage in this behavior, $\beta = .20$, $p = .018$. Gender also had a significant negative effect on the behavior. Specifically, women are more likely to engage in this behavior compared to men, $\beta = -.57$, $p = .014$. Other factors such as habits, cost, social norms, conformity, convenience, perceived behavioral control, as well as demographic variables age and education, do not significantly influence this behavior. See table 6 for summary.

Table 6: Results of multiple regression with behavior of picking up and throwing plastic bags in the bin as dependent variable.

Variable	**Estimate**	***Robust SE***	***t***	***p***
Intercept	.3.12	.96	3.25	.001
Habits	-.11	.07	-1.49	.137

Intentions	.20*	.08	2.38	.018
Cost	.00	.06	0.04	.971
Social norms	-.01	.08	-0.17	.868
Conformity	.04	.08	0.52	.605
Perceived behavioral control	.08	.06	1.34	.179
Convenience	-.01	.05	-0.12	.906
Age	.00	.01	1.08	.280
Gender	-.57*	.23	-2.46	.014
Education	-.22	.17	-1.26	.207

Note. *** p < .001; ** p < .01; * p < .05

Observations

Demographics. In the observations, we collected data on observed gender and estimated age of the customers. The sample of 285 participants comprised 127 females and 158 males. 146 participants are estimated to be in the age range of 18 to 40, while 139 participants are estimated to be 40 years or older. See table 7 for summary.

Table 7: Sample description of the observational study.

Demographic variable	***n***	***%***
Observed gender		
Female	127	44.6
Male	158	55.4
Estimated age		
18-40	146	51.2
>40	139	48.8
Total *N*	**285**	

OLS Ridge regression analysis. The model provides a good fit for the observed data and that at least one of the predictor variables is significantly related to the outcome variable of choice, $F = 94.75$, $p < .001$. See table 8 for frequency of observed plastic bag behavior.

Table 8: Frequency for variables included in the model.

Variable	**Frequency**		***%***	
	yes	**no**	**yes**	**no**
Cashier asks if customer needs a bag	235	50	17.5	82.5
Customer purchases plastic bag	113	172	39.6	60.4
Customer brings own bag	153	132	53.7	46.3

An OLS Ridge regression was run to predict purchasing of plastic bags at the checkout. The overall model was statistically significant, Wald $\chi 2 = 378.99$, $p < .001$, indicating that it effectively predicts plastic bag purchases. The model exhibits a reasonably good fit, as indicated by the Buse (1973) $R^2 = 0.58$, suggesting that approximately 58% of the variance in purchasing plastic bags is explained by the model.

The model indicates that the cashier asking if the customer needs a bag increases the likelihood of buying a bag by $\beta = .37$, $p < .001$, while individuals who bring their own bag to shop are less likely to buy a bag, $\beta = -.66$, $p < .001$. Gender was not statistically significant, thus showing a tendency for women to purchase plastic bags at the checkout compared to men. Age did not significantly influence bag purchase behavior. Table 9 summarizes the results.

Table 9: Results of OLS Ridge regression with purchased plastic bag as outcome variable.

Variable	**Coefficient**	***SE***	***t***	***p***
Intercept	.41	0.55	7.45	<.001

Cashier asks if customer needs a bag	.37***	.05	7.29	<.001
Customer brings own bag	-.66***	.04	-16.82	< .001
Gender	.07	.04	1.74	.084
Age	-.00	.04	-0.06	.955

Note. *** p < .001; ** p < .01; * p < .05

Comparison Data

Research question 3, "what differences exist in the behavioral patterns in plastic bag consumption in Norway and South Africa", necessitates a comprehensive overview of the variables we intend to compare. See table 10 for summary of survey results, and table 11 for summary of frequency of choice of shopping bags in both countries.

Table 10: Comparison of regression results with the behavior of bringing one's own bag to store from Norway and South Africa.

Variable	**Estimate**	***SE***	***t***	***p***
Norway				
Intercept	3.2	.70	4.60	< .001
Habits	-.43***	.06	2.67	< .001
Intentions	.31***	.07	4.61	< .001
Cost	.26***	.04	6.59	< .001
Social norms	.16**	.06	2.63	.009
Perceived behavioral control	.04	.04	0.99	.321
Convenience	-.11**	.04	-3.19	.002
South Africa				

Intercept	3.27	.66	4.99	<.001
Habits	-.20***	.20	-3.59	<.001
Intentions	.18*	.08	2.39	.017
Cost	-.01	.04	-0.23	.819
Social norms	.36***	.36	5.59	<.001
Perceived behavioral control	-.15**	.05	-3.18	.002
Convenience	-.08	.05	-1.78	.075

Note. *** p < .001; ** p < .01; * p < .05. Norway N=540; South Africa N=566.

Table 11: Frequency table for customer's choice of shopping bags in Norway and South Africa.

Variable	**Frequency**		***%***	
	yes	**no**	**yes**	**no**
Norway				
Cashier asks if customer needs a bag	235	50	17.5	82.5
Customer purchases plastic bag	113	172	39.6	60.4
Customer brings own bag	153	132	53.7	46.3
South Africa				
Cashier asks if customer needs a bag	210	112	65.2	34.8
Customer purchases plastic bag	196	126	60.9	39.1
Customer brings own bag	51	271	15.8	84.2

Note. Norway N=285; South Africa N=322.

Discussion

The current study investigated factors influencing plastic bag behavior among a Norwegian sample through both survey questionnaires and behavioral observations, specifically we wanted to examine the behavior of bringing one's own bag to store when grocery shopping. The findings revealed that habits were the most significant predictor of bringing one's own bag, indicating that stronger habits are associated with a lower likelihood of bringing own bags, followed by intentions, the cost associated with plastic use, and social norms. Convenience was also significant but had smaller effects, thus indicating that individuals find it more convenient to purchase plastic bags at the store than bringing one's own from home. Interestingly, perceived behavioral control, or knowledge about alternatives, and conformity were not influential factors. Age, gender, and educational level does not have a significant impact on the likelihood of bringing own bags.

Remaining multiple regression models suggest that the cost of plastic bags influence the behavior of reusing plastic bags at home; other factors does not significantly predict this behavior. For advocacy behavior, findings indicate that intentions strongly predict this, as well as social norms and conformity. Additionally, convenience exhibits a significant, negative effect on advocacy behavior. Lastly, analysis reveals that intentions are the most significant predictor of the behavior of picking up and disposing of plastic bags. Gender also significantly affects this behavior with women being more likely to engage in it than men.

Finally, we conducted observations in stores and employed a ridge regression to analyze factors influencing plastic bag purchases at checkout. Findings revealed that the cashier asking if the customer needs a bag increased the likelihood of buying a bag, while individuals who brought their own bag were less likely to purchase one. Gender showed a marginal significance, suggesting that women tended to purchase plastic bags more often than men. Age did not impact purchasing behavior.

Following, the findings will be discussed in light of the presented theory and previous research. Finally, the limitations of the study will be considered, as well as implications for practice and theory, followed by suggestions and opportunities for further research.

Understanding Human Behavior and Environmental Factors

Understanding human behavior encompasses more than visible actions; it includes inner reflections and decision-making processes, as well as automatic processes, for example habits. Environmental behavior is significantly shaped by both situational and psychological factors, as previous research has identified a range of drivers and barriers that are presumed to affect both intended and observed plastic bag behavior (e.g., Heidbreder et al., 2019; 2020). Despite widespread awareness of the adverse environmental consequences of plastic usage, its use continues to persist, eventually underscoring the influence of additional factors such as habits, social norms, intentions and more. The next sections will discuss the results of the study, taking previous research into consideration.

Habits and Psychological Predictors of Plastic Bag Behavior

In this study, we wanted to look at how habits and other psychological and demographic factors predict self-reported plastic bag behavior, specifically, the behavior of bringing one's own bag to store when grocery shopping. All self-reported plastic bag behavior will be deliberated; however, the aforementioned behavior will be the focus of the discussion.

Building upon research question one "How do habits, along with intentions, social norms, cost, convenience, conformity and perceived behavioral control, and demographic variables, predict individuals self-reported plastic bag behavior?", the study results found habits to be the strongest predictor of bringing one's own bag, although in a negative direction. This suggest that individuals with stronger habitual tendencies are less likely to bring their own bags when shopping. Habits have been highlighted through a number of studies as one of the most important predictors of environmental behavior, including plastic bag behavior (e.g.,

Abiola et al., 2023; Heidbreder et al., 2019; Makarchev et al., 2022). Research consistently demonstrates the prevalence of habitual plastic bag purchasing among supermarket customers, despite the availability of more eco-friendly alternatives, awareness of environmental issues and various interventions (Abiola et al., 2023; Makarchev, 2022; Spranz & Schlüter, 2023). A study by Zen et al. (2013) found that during a 5-day no plastic bag-campaign, approximately 60% of the respondents admitted forgetting their reusable shopping bags three times or less, implying a highly habitual behavioral pattern. Our study results align with these findings, highlighting habits as a significant predictor of the behavior of bringing one's own bag when shopping, contributing to the research suggesting that the purchasing of plastic bags and subsequently forgetting to bring reusable bags is a deeply ingrained habitual behavior.

The study results on habits influence underscore the substantial role they play in shaping our behavior and the impact they have on our lives. The effects observed in our findings contribute to the research on the power of habits, including how they often overshadow other valued aspects that we may consciously strive to uphold. This highlights the influence that habits exert over our decision-making processes and also underline the challenge of breaking or changing them. Establishing new habits such as bringing more environmentally friendly carriers takes time and effort as the brain would need to form new neural connections. Simply providing new information may not be sufficient, as existing habits can suppress incoming information that contradicts them. Since habits are responses to stable conditions, breaking them necessitates altering these conditions. This might entail a shift in physical surroundings as well as a change in mindset regarding the situation. The habitual behavior of plastic bag consumption could therefore be challenging to change without the intention and awareness of acting in a pro-environmental way, as well as sufficient effort and practice to do so.

Prior research has shown that the strength of intentions is crucial when adopting a new behavior, but over time, intentions are outweighed by habits. The current study found intentions to reduce personal plastic bag use and support measures that work to decrease overall plastic bag consumption emerging as significant factors. Contrary to previous findings where nearly half of consumers did not express intentions to abandon plastic bags (Makarchev et al., 2022), this study's participants' intentions were the second strongest predictor for bringing one's own bag when shopping. Intentions to contribute to an environmental issue in a positive way could be translated into more concrete intentions, like bringing a reusable bag to the store, and ideally, also into actual behavior.

The relationship between intentions and behavior has long been of interest among behavioral researchers, often criticized for its weakness in predicting behavior (Greaves et al., 2013). Liu et al. (2020) suggest that environmental behavioral intentions might mediate the relationship between environmental knowledge and pro-environmental behavior. Behavioral intentions, defined as internal stimulus, is commonly seen as the driving force behind behaviors. Liu et al. (2020) found a significant positive influence of environmental behavioral intentions on pro-environmental behaviors. However, habits can moderate the impact of both intentions and personal norms on environmental behavior, suggesting that strong habits can override even well-intended behaviors. In our study, intentions proved to be weaker than the habits for the behavior of bringing one's own bag, suggesting that the habitual act of purchasing plastic bag is stronger than individuals' intentions not to. This is also in line with previous research, showing that even when people are willing to reduce their consumption, the purchasing habit overpower the intentions of bringing one's own bag (Bartolotta & Hardy, 2018). The implementation of intentions have been suggested as a way to counteract habits, which involves making concrete plans for when and where to execute the intended behavior and associating specific actions with situational contexts (Klöckner & Verplanken, 2018).

The study's results further highlight the significant influence of the cost of plastic bags on the behavior of bringing one's own bag, suggesting that perceiving a financial cost associated with the use of plastic bags is associated with a higher likelihood of bringing own bags when shopping, contradicting previous findings on the topic. Recent data from Handelens Miljøfond (2023) indicate a significant decrease in the number of plastic bags purchased since the levy was increased in August 2023. However, a lot of people continue to buy them whilst expressing dissatisfaction about the increase in price, demonstrating a tendency to adapt to measures over time, as stated in Dikgang et al. (2012a). Monetary incentives on plastic bags have been introduced in various countries worldwide, including South Africa, Ireland, Norway and Australia, however with varying degrees of success (e.g., Cherrier, 2006; Dikgang et al., 2012b; Rivers et al., 2017). Adane and Muleta (2011) found that people tend to choose their packaging alternatives based off affordability. In their research, it was found that people perceive other, often more eco-friendly alternatives as more expensive than plastic bags, and therefore chose plastic bags when shopping. Thus, it seems that people fail to consider the long-term costs. While opting for a slightly pricier reusable bag may seem like a one-time expense, it ultimately saves money over time compared to continually purchasing plastic carrier bags. This foresight seems to elude many consumers, perhaps because they don't think ahead or plan for future actions. The immediate affordability of plastic bags seems to overshadow the benefits of investing in reusable alternatives, showing the tendency to prioritize present over long-term convenience and affordability.

Whilst social norms are found to be one of the most important predictors for use or avoidance of plastic bags (e.g., Heidbreder et al., 2019), this is not the case for the current study. Social norms proved to be a significant predictor, however with a smaller effect, surpassed by habits, intentions, and cost. A previous study revealed that social norms significantly impact the willingness to choose alternative carrier bags over plastic bags,

guided by descriptive social norms prevalent in their given community (Arı and Yılmaz, 2017). Descriptive social norms reflect what behavior are commonly practiced or accepted within the society, based off of the observations of others. In our study, we especially wanted to investigate perceived subjective norms, including the beliefs about whether important people, such as friends and family, think one should engage in a specific behavior. Similar to previous research, the results suggest that the opinion of friends and family are highly valued by the population, assuming they would be supportive of making more environmentally friendly decisions, like bringing a reusable bag when shopping.

Several studies have revealed that convenience is positively related to the intentions to use plastic bags (e.g., Sun et al., 2017). Similarly, our results found convenience to have a negative, significant effect on the behavior of bringing one's own bags to shopping in our study, meaning that individuals find it more convenient to purchase plastic bags at the store than bringing one's own. This is also found to be the reality in countries such as South Africa, where the majority of people tend to buy new bags at each visit to the grocery store, as it is inconvenient to bring bags from home (Dikgang et al., 2012a). The perceived convenience is composed of several other factors, including the availability and perceptions of the benefits from using them (Sun et al., 2017). This is also stated in O'Brien and Thondhlana (2019), who could reveal that the high usage of plastic bags was primarily due to the perceived convenience, suggesting that people might purchase plastic bags only because they are there and available. The impact of convenience on plastic bag behavior may have to do with the strong habits also disclosed in the survey study. The formation of habits will rely on convenience to a certain extent. It is known that individuals tend to develop habits around behaviors or actions that are easy to do or readily available, that is, convenient. Through repetition of these easy and available behaviors, habits are ultimately established (Chen et al.,

2020; Wood & Rünger, 2016). As our brains tends to take the easy way around, convenience would potentially play a significant role in our daily routines, reinforcing behavior over time.

The remaining factors in our study did not demonstrate significant effects on the behavior of bringing own bags when shopping. Perceived behavioral control, conformity, as well as demographical factors age, gender and education, were found to be non-influential factors in predicting this behavior. Perceived behavioral control, or participants' knowledge about other alternatives, not being significant for the model could suggest that while many individuals possess sufficient knowledge about greener alternatives, they may not always opt to use them. This behavioral choice could again be attributed to several factors, such as the habitual behavior or perceived convenience of purchasing plastic bags, or inconvenience of bringing your own bags. The study also wanted to investigate if conformity and feelings of unease could affect individuals' plastic bag behavior, especially when being offered plastic bags at the checkout. Results indicate that conformity is not associated with the behavior of bringing one's own bag, suggesting that most people do not find it uncomfortable to refuse a bag at the checkout. This is contrary to Cherrier (2006), who could reveal that feelings of guilt and fear of judgment from other customers in accepting and carrying plastic bags instead of reusable ones in the supermarket was expressed in most informants' narratives. Previous research has stated that gender and age differences in environmental behavior are notable, with women generally more inclined to embrace alternatives to plastic bags, as well as exhibit higher levels of engagement in practices such as reusing, reducing, and recycling (e.g., Heidbreder, 2019). Older individuals typically participate more in initiatives like no plastic bag-campaigns, while younger participants show willingness to sacrifice convenience for environmental causes. However, the current study found no significant differences based on age and gender. Similarly, none of our analyses revealed a significant impact of educational level. Educational level has earlier proven to be a predictive variable when it comes to other

environmental behavior, such as littering (Heidbreder et al., 2019). One possible explanation for the non-significance of educational level amongst the population, could be that information and knowledge on plastic characteristics and pollutions is not exclusive to higher educated people, being quite widespread and accessible.

A Brief Discussion of Additional Models

As for the remaining regression analyses performed in this study, specifically on the behaviors of reusing plastic bags at home, advocacy, and picking up and disposing of plastic bags, some interesting results were found. When examining predictors for the behavior of reusing plastic bags from the store at home, the cost of plastic bags emerges as a significant predictor. It suggests that individuals who perceive a financial cost associated with using single-use plastic bags and reducing personal use after the price increases, are more likely to reuse their plastic bags at home, e.g. as garbage bags. This could indicate that individuals may find bags too expensive to just throw them away after one use. Moreover, in Norway, it is quite common to reuse plastic bags from the store as garbage bags (Mepex & Systemiq, 2023; Mørch-Kontny et al., 2021). Additional results also suggest that intentions, along with social norms and conformity, strongly predict advocacy behavior (i.e. actively advocating with friends/family that we should use fewer plastic bags). This indicates that ~~i~~individuals who intend to reduce plastic bag usage are more inclined to advocate for this cause, similarly, does the perception of social norms reinforce people's belief that promoting this behavior aligns with societal expectations, conforming to norms and what one believes is right. Consistently, intentions emerge as the most significant predictor of the behavior of picking up and disposing of plastic bags. Gender also affects this behavior with women being more like to engage in it than men, as highlighted in previous studies (e.g. Heidbreder et al., 2019). Again, intentions to reduce personal consumption of plastic bags, as well as support measures that work to reduce plastic bag consumption, proves to be an influential predictor of the behavior in question, aimed at mitigating plastic pollution from bags in the natural environment.

However, these findings were not the focal point of the study, and merits for further investigation.

Discussion of Observational Data

As for research question two, we wanted to examine the prevalence of bringing own bags versus purchasing plastic bags, along with the observed demographic variables influence on this behavior. The observational analysis indicates that at least one of the predictor variables is significantly related to the outcome variable and effectively predicts plastic bag purchase. Results shows that if the cashier asks if the customer needs a bag, it increases the likelihood of buying one, whilst individuals who bring their own bags are less likely to buy plastic bags in store. It is expected that individuals who do grocery shopping without bringing their own bag, will need to buy one or more plastic bags to carry the groceries home, in the same way that individuals who bring their own bag would not need to buy extra bags – unless unexpected circumstances arise, such as buying more items than anticipated.

In predicting plastic bag purchases, gender was not statistically significant, yet showing a tendency for women to purchase more plastic bags at the checkout compared to men. However, this discrepancy could simply be attributed to coincidences, for example time of the day or personal obligations in the period of observations. Age did not significantly influence bag purchase behavior. These observations align with the observations of a previous study conducted by Cherrier (2006), showing that green bag shoppers (shoppers opting for reusable bags) are not gender-specific and combine all ages.

According to a study on plastic bag usage in the US, plastic bags and reusable bags are used approximately the same amount of time (Bartolotta & Hardy, 2018). Our study results indicate that nudging from the store staff increases the likelihood of purchasing plastic bags. However, the results found more people saying ‘no’ to a bag than ‘yes’ (172 vs. 113), indicating that the majority do remember to bring their own bag or any other option, setting

their intentions to life. The observations also show that approximately 54% of customers brought their own bag shopping during the period of the observations, while 40% bought one or more plastic bags at the checkout. The remaining 6% neither brought nor bought a bag but carried the goods by hand. One potential reason for the cashier not offering a bag was reusable bags that consumers held in their hands, signaling no need for additional plastic bags. Cherrier's study (2006) found that most individuals who had been using reusable shopping bags for more than 1 year and had assimilated the practice in their shopping routines, were usually carrying two or more reusable bags. By acquiring the routine of bringing at least one reusable bag when shopping, one can avoid having to buy a plastic bag due to poor planning.

Studies demonstrate that respondents think a plastic bag fee or ban is reasonable (Bartolotta & Hardy, 2018), however, in practice, it does not always seem to work particularly well because many people still forget to bring reusable bags with them to shopping. The same respondents were in favor of other financial incentives, such as store discount program, signs with reminders in store parking lots, or a reusable bag lending program in store. Each intervention offers potential benefits, for instance motivation, immediate outcomes and increased awareness, but also comes with limitations, such as maintenance or being insufficient to actually change behavior.

Theoretical Perspectives

As mentioned, the theory of planned behavior, the value-belief-norm theory, and the theory of reasoned action, amongst other socio-cognitive models, are widely used to predict environmental behavior. However, such models have fallen short in explaining the habitual aspect of these behaviors, displaying a need of other frameworks to explain habitual influence.

The Habit Discontinuity Hypothesis

The habit discontinuity hypothesis proposes that behavior change interventions are most effective during life course changes, when individuals are more receptive to new information and open to change their habits (Verplanken et al., 2008). This is particularly relevant for environmentally friendly behaviors, which are often deeply ingrained habits conducted regularly and with little conscious intent (Verplanken & Roy, 2016). Habits can be resistant to change due to superficial decision making and a lack of interest in new information (Heidbreder & Schmitt, 2020). However, major life changes or environmental modifications can create a '*window of opportunity'* for behavior change, as individuals reassess their habits and become more open to adopting new behaviors (Fujii et al., 2021; Verplanken & Roy, 2016).

Behavior change interventions are found to be more effective in context of habit disruption. Changes in context make them more influential and prompt new choices and decisions (Verplanken et al., 2008). In the current study, we are not able to ascertain if any of the participants are undergoing life course changes that could promote a shift in their behavior and habits, in addition to the fact that no participants underwent a planned intervention. However, we can interpret the study results with this theory in mind. Drawing on the significant results, it could be theorized that changes in these predictors (e.g., social norms, intentions, cost) can disrupt established habits and further influence the behavior of bringing own bags. Also, hypothetically, some participants may be in the process of moving, becoming a parent, or changing occupations, which can contribute to being more receptive to information and change. Other life course changes that could foster open-mindedness include altering one's daily routines, making financial decisions such as prioritizing savings, or making lifestyle changes. These changes, whether big or small, have the potential to disturb

existing habits, creating a window of opportunity to initiate change or break ingrained patterns.

The Dual Process Model

The Dual Process Model proposes two distinctive modes of information processing: the automatic (*system 1*) and the reflective system (*system 2*). System 1 operates rapidly and unconsciously, relying on mental shortcuts to make quick judgments and responses. Habits, being automatic and nonconscious, are considered part of this system. In contrast, system 2 requires effortful and deliberate processing, engaging in conscious reasoning and complex cognitive tasks. The interplay between these systems influences the formation, maintenance, and modification of habits and behavior. Initially, conscious effort and cognitive resources from system 2 are employed to form habits. With repetition and reinforcement, behaviors transition to become automatic, integrated within system 1.

The study results can be understood in light of the dual process model, positing two distinct modes of information processing and decision making. Behaviors related to plastic bag usage may be influenced by both system 1 and 2. Individual's habits of using plastic bags may largely operate within the automatic system, characterized by ingrained behaviors often performed without conscious awareness. On the other hand, intentions to reduce plastic bag usage and support measures to decrease consumption may involve the reflective system, as intentions require conscious effort and deliberate processing, engaging in reasoning and other cognitive tasks.

The interplay between these systems can shed light on the study's findings. For instance, the significance of intentions, social norms, and perceived behavioral control, identified in the study, may reflect the influence of system 2 processes. Individuals may consciously consider their intentions, social influences, and perceived control when making decisions about plastic bag usage. Additionally, the presence of habitual behaviors, as indicated by the significant

influence of habits, align with the automatic processes of system 1, which may persist despite intentions or external influences, highlighting the challenge of behavior change. Breaking or changing a habit requires the engagement of both the reflective and automatic system. While automatic processes trigger habits, reflective processes can exert control over these impulses through conscious awareness. Focusing on the automatic system, disrupting habitual responses could contribute to breaking the habit while concurrently adjusting the environmental cues associated with the behavior (Wood et al., 2014). Targeting the reflective system involves cognitive restructuring, self-monitoring to enhance conscious decision making, and goal setting.

Overall, the study findings suggest that both automatic and reflective processes contribute to individuals' behaviors related to plastic bag usage. By understanding these processes and employing strategies for habit change and aligning the goals and intentions in both systems, this could provide a long-term habit change.

Examining Differences: A Comparison Between Norway and South Africa

Drawing on research question three, "What differences exist in the behavioral patterns in plastic bag consumption in Norway and South Africa", the next section will include a brief discussion of the similarities and differences found between the studies conducted in Norway and South Africa. The studies both employ a multi-method approach, as well as having comparable sample sizes.

According to the study results, both Norwegian and South African consumers hold similar perspectives when it comes to plastic bag purchase, albeit with differing emphasis. Survey findings in South Africa pinpoint social norms, habits, perceived behavioral control, intentions, and perceived convenience as significant predictors for reusable bag use, while the cost of plastic bags were not considered impactful. Social norms were found to be the strongest of all predictors. Survey findings in Norway highlight habits, intentions, cost, social

norms, and convenience as the most significant predictors for bringing reusable bags. Perceived behavioral control and conformity were not significant.

Both studies then support previous study findings, such as habits emerging as one of the most significant predictors for plastic bag behavior, but also demonstrate variations among the strength of the different predictors. For instance, while the cost of plastic bag was found to be insignificant in South Africa, pointing towards the ineffectiveness of the plastic bag levies implemented by the government, it emerged as the third most influential factor for consumers in Norway. A potential reason for this difference could be that over the years, Norway has consistently increased the prices for plastic carrier bags in most grocery stores (from 1 NOK to the current 4,25 NOK = 0.40 USD), perhaps leading to the perception that a bag is "too expensive" for what it is. In South Africa however, the levy started at 46 ZAR cents (0.03 USD) and was later lowered to 32 ZAR cents (0.02 USD). The levy led to short-term reductions in South Africa, while the steady increase of price in Norway has led to a continuous decrease in plastic bag purchases.

Following, intentions emerged as a significant predictor for bringing one's own bag in both countries, however, to varying degrees. Intentions emerge as the second most important predictor in Norway, whereas they hold less importance for the South African population, yet statistically significant. This contributes to the thought that having intentions to do something can eventually be transformed into actual behavior. Perceived behavioral control had a negative, significant effect for the South African study, indicating that individuals are more likely to purchase plastic bags if they perceive fewer alternatives to it. This did not have a significant effect in the Norwegian study. Further, the Norwegian study suggest that perceiving bringing own bags as inconvenient is associated with a lower likelihood of engaging in the behavior. This had a negative tendency in South Africa as well, however not significant.

The observed rate of reusable bag use in grocery stores in South Africa was a mere 15,8%, compared to strikingly 53,7% in Norway. Both studies could agree that asking customers if they want a bag leads to the highest rates of plastic bag purchases while significantly fewer plastic bags were acquired when the cashier did not ask the customers if they want a bag, potentially because the customer was forced to purposefully ask for a bag in these situations. The observed differences in reusable bag use between Norway and South Africa could be attributed to a combination of various factors, such as political or cultural factors. Government policies and regulations can influence individual behavior and consumption patterns. The Norwegian government are subject to the EU plastic directive, aiming to reduce annual plastic bag consumption, as well as implementing banning of single use plastic items and imposing higher fees. Similarly, the South African government has attempted to introduce various interventions to reduce plastic bag consumption, however, with less success. Cultural norms and values surrounding sustainability can also influence this type of behavior. The residents in South Africa and in Norway clearly has some similarities, but also differences according to the survey results, that may impact their use of reusable bags in reality.

Results like these emphasizes the significance of cultural context and values, socioeconomic factors, problem awareness and perceived alternatives, among others. These factors highlight the importance of considering contextual factors, as well as conducting further research to understand the nuances across cultural contexts. It is also important to highlight that the South African survey study included a few other context relevant questions (*e.g. "From the year 2027 all plastic bags in South Africa must be made of 100% recycled material. I am convinced that these types of recycled plastic bags will reduce plastic pollution"*), which was removed when developing the Norwegian version. Additionally, items measuring discomfort were transformed to an overall scale for the Norwegian sample, but not for the South African.

Theoretical and Practical Implications

The study has provided insight into how individuals behavior is influenced by various psychological factors and to what extent. For example, the study can contribute to confirming habits as one of the most significant factors for behavior and behavioral change. The results also highlight the importance of intentions and how the implementation of intentions can support behavioral change. Additionally, the comparison between Norway and South Africa illustrates how cultural context can play a crucial role in the establishment of behavior and habits, and how different countries and cultures may require different types of interventions for behavioral changes, based on the influence of the various variables under investigation. The research could therefore work as a reminder of the extensive impact of habits and the necessity to understand and manage them efficiently in the pursuit of behavioral change. As the current study only looked into one single dimension of environmental behavior, further research could be needed on other environmental aspects or more in-depth on plastic consumption including different variables. This also underscores the importance of considering potential confounding variables and further analyses to better understand the relationship between different variables and environmental behavior.

When it comes to practical implications, reducing the use of plastic bags will require interventions at multiple levels, including political, societal, and individual.
Retail chains earn millions from plastic bag sales, even alongside the fee imposed on members of Handelens Miljøfond. Our observations indicate that prompts from the store employees lead to increased bag purchases, suggesting that fewer prompts may results in fewer purchases. Asking employees not to offer bags would entail a significant economic loss for the stores, making it highly unlikely to implement in practice, despite the considerable environmental burden. However, the purpose of the price increase is to reduce the consumption of plastic bags and simultaneously encourage consumers to reach for more

environmentally friendly alternatives when shopping in stores. Increasing the membership fee and the plastic bag levy even more could contribute to further reduction in plastic bag consumption.

More and more grocery stores are implementing self-checkout counters, where the customers undertake the process of scanning items, as well as handling payment and bagging, without the presence of a store employee. Before proceeding to payment, a window displaying “number of bags” will appear on the screen. Currently, the standard options include “0 bags”, “1 bag”, “2 bags”, and so forth. To reduce the use of plastic bags, an alternative approach could entail the absence of this window prompting bag selection automatically, requiring customers to manually add bags if truly necessary. However, a challenge with this approach is that if the customer forgets to add bags manually, they may end up taking one or more bags without paying for them. This, along with a financial loss for both the store and eventually Handelens Miljøfond, could result in inaccurate statistics on the number of plastic bags sold, making interventions even more challenging.

In the context of habit change, there are some strategies that potentially could contribute to change or interruption of old habits. Firstly, reminders or prompts can serve as effective ways to support the formation or disruption of habits. Prompts like visual cues or other reminders could be installed in parking lots or by store entrances (e.g., Bartolotta & Hardy, 2018), thus relying on the customers to have reusable bags readily available. This could be considered a social norm intervention, aimed at influencing behavior by highlighting something perceived as acceptable or expected. Social norms interventions then emerge as a convenient strategy to promote pro-environmental behavior change. Studies show that such interventions are effective at inducing significant changes, especially descriptive norms, public commitment (injunctive), and normative (injunctive) feedback (Abrahamse & Steg, 2013; De Groot et al., 2013; Farrow et al., 2017). Handelens Miljøfond is also engaged in

nudging consumers through posters prominently displayed across the cityscape and in various media outlets.

Eventually, reducing plastic bag consumption will necessitate a combination of policy reforms and shifts in individual behavior, alongside ongoing initiatives to raise awareness about the problem and promote sustainable alternatives.

Limitations

This study has some limitations as follows. Firstly, the individuals who responded to the survey were not necessarily the same individuals who were observed in the grocery store. The survey was administered through telephone interviews, thus within the same city that the observations were conducted. However, since one cannot be certain about the same individuals being surveyed and observed, it could propose uncertainty in the results. Additionally, the observations did not take into account the quantity of goods purchased by each observed individual. Secondly, geographic and cultural contexts may also limit the study. The research is conducted in a specific municipality with its unique context, consisting of a range of socio-economic and demographic backgrounds. Therefore, the findings might not directly translate to other geographic and cultural contexts, depending on the composition of individuals.

The methods of choice could also carry some limitations. While self-report questionnaires are considered a valuable tool for collecting data on subjective experiences from a large number of respondents, one should be aware of its weaknesses. People could fail in observing their own behavior or lack insights into their own thoughts, feelings and behaviors. Social desirability, or when respondents may provide answers they believe are socially acceptable or expected, rather than reflecting their true thoughts and behaviors, may also occur in self-reported questionnaires. Reflecting on this, non-response bias can occur in

any study. Individuals who choose not to participate may differ significantly from those who do not participate, potentially leading to biased results.

Conclusion

The purpose of this study was to investigate individuals' habitual consumption behavior and the variations therein, as well as the underlying psychological factors influencing this behavior. By examining the plastic bag habits of Norwegian consumers, we were able to recognize several factors contributing to the perpetuation of the behavior of bringing one's own bag to store. The findings reveal that habits, intentions to reduce plastic pollution, social norms, cost, and convenience significantly influence the use of plastic carrier bags. Furthermore, behavioral observations in stores indicate that over half of consumers (54%) bring their own bags or an alternative to store, whereas 40% opt to purchase plastic bags when shopping. These observations suggest that a substantial proportion of individuals are able to act on their intentions to reduce personal plastic use, although plastic usage remains highly habitual or deeply ingrained within the population. Similar patterns were observed in a parallel study conducted in South Africa, albeit with variations in the strength of the variables. However, the South African study could reveal discrepancies between individuals self-report and observation of behavior. While the Norwegian population is making progress in reducing plastic bag usage, further efforts are needed to align with the plastic bag directive from the EU (Miljødirektoratet, n.d.). The study suggests that interventions focusing on habit change, including policy adjustments and individual initiatives, along with ongoing campaigns for spreading awareness and promoting sustainable options, can contribute to an overall reduction in plastic consumption. Future research should explore additional dimensions of environmentally friendly behavior to enhance understanding, as well as assess the efficacy of information and attitude campaigns, given their growing prevalence in different media outlets.

Ethics

The present study is approved by the Research Ethics Committee at the Department of Psychology, NTNU (2023/003). InFact is responsible for the General Data Protection Regulation (GDPR) in line with the EU and EEA privacy policy regulations. No personally identifiable information was collected about the participants, and it will not be possible to track individual participants. Participants were asked to provide specific demographic information, including gender, age, and level of education. This information was used to account for and compare the habits, intentions, and behavior of the sample concerning the consumption of plastic bags in grocery shopping. Consequently, there are no direct disadvantages for individuals participating in the study, nor did the study request or process information about third parties.

The data obtained from the data collection was processed in hardware belonging to the responsible institution's storage areas, and external services or networks, such as providers of cloud services. Access to the data will be restricted to the project manager and the student. Data and information will be safeguarded through measures such as anonymization of participant responses via questionnaires and access controls that prevent unauthorized individuals from accessing the data.

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Appendix

Appendix A: Survey Questionnaire (Norwegian version)

DEL A: DEMOGRAFI

1. **Hvilket kjønn identifiserer du deg som?**

Mann	
Kvinne	
Ikke-binær	
Annet (spesifiser)	
Jeg foretrekker å ikke svare	

2. **Hvor gammel er du?**

18 - 29	
30 - 39	
40 - 49	
50 - 59	
60 - 69	
70 eller eldre	

3. **Hva er ditt høyeste fullførte utdanningsnivå?**

Ingen formell utdanning	
Grunnskole	
Videregående opplæring	
Høyere utdanning (universitet/høyskole o.l.)	

DEL B: SPØRREUNDERSØKELSE

Videre ønsker vi å undersøke dine tanker rundt bruk av plastposer. Vennligst svar så ærlig og spontant som mulig – det er ikke noe rett eller galt! Huk av for alternativet som passer deg best.

4. Å velge plastposer ved dagligvarehandel er noe …

a) Jeg gjør automatisk.

1. Veldig uenig	2. Uenig	3. Litt uenig	4. Nøytral	5. Litt enig	6. Enig	7. Veldig enig

b) Jeg gjør helt ubevisst.

1. Veldig uenig	2. Uenig	3. Litt uenig	4. Nøytral	5. Litt enig	6. Enig	7. Veldig enig

c) Jeg gjør uten å tenke over det.

1. Veldig uenig	2. Uenig	3. Litt uenig	4. Nøytral	5. Litt enig	6. Enig	7. Veldig enig

d) Jeg takker ja til før jeg selv innser det.

1. Veldig uenig	2. Uenig	3. Litt uenig	4. Nøytral	5. Litt enig	6. Enig	7. Veldig enig

5. De fleste personer hvis meninger jeg verdsetter forsøker å bruke færre plastposer når de handler.

1. Veldig uenig	2. Uenig	3. Litt uenig	4. Nøytral	5. Litt enig	6. Enig	7. Veldig enig

6. **De fleste viktige personer i mitt liv vil støtte meg dersom jeg forsøker å unngå og bruke plastposer når jeg handler.**

1. Veldig uenig	2. Uenig	3. Litt uenig	4. Nøytral	5. Litt enig	6. Enig	7. Veldig enig

7. **De fleste viktige personer i mitt liv forventer at jeg forsøker å unngå og bruke plastposer.**

1. Veldig uenig	2. Uenig	3. Litt uenig	4. Nøytral	5. Litt enig	6. Enig	7. Veldig enig

8. **Å bruke plastposer ved dagligvarehandel er det mest praktiske alternativet.**

1. Veldig uenig	2. Uenig	3. Litt uenig	4. Nøytral	5. Litt enig	6. Enig	7. Veldig enig

9. **Jeg synes det er ukomfortabelt å takke nei til plastposer i kassen …**

   a. **… Fordi ingen andre gjør det.**

1. Veldig uenig	2. Uenig	3. Litt uenig	4. Nøytral	5. Litt enig	6. Enig	7. Veldig enig

   b. **… Fordi jeg er redd for å vekke uønsket eller ubehagelig oppmerksomhet.**

1. Veldig uenig	2. Uenig	3. Litt uenig	4. Nøytral	5. Litt enig	6. Enig	7. Veldig enig

10. Jeg velger plastposer fordi jeg ikke har eller vet om andre alternativer.

1. Veldig uenig	2. Uenig	3. Litt uenig	4. Nøytral	5. Litt enig	6. Enig	7. Veldig enig

11. Jeg bruker <u>ikke</u> plastposer fordi jeg må betale for dem.

1. Veldig uenig	2. Uenig	3. Litt uenig	4. Nøytral	5. Litt enig	6. Enig	7. Veldig enig

12. Jeg har redusert min bruk av plastposer i dagligvarehandel som følge av den nylige prisøkningen (4,25 kr), sammenlignet med min bruk av plastposer før prisøkningen.

1. Veldig uenig	2. Uenig	3. Litt uenig	4. Nøytral	5. Litt enig	6. Enig	7. Veldig enig

Vennligst huk av for alternativene som best beskriver din <u>atferd de siste 4 ukene.</u>

13. I løpet av de siste 4 ukene har jeg gjenbrukt plastposer fra dagligvarebutikken hjemme (f.eks. som søppelpose).

1. Veldig uenig	2. Uenig	3. Litt uenig	4. Nøytral	5. Litt enig	6. Enig	7. Veldig enig

14. I løpet av de siste 4 ukene har jeg tatt med mine egne poser (bomullsnett, papir, andre plastposer o.l.) når jeg handler.

1. Veldig uenig	2. Uenig	3. Litt uenig	4. Nøytral	5. Litt enig	6. Enig	7. Veldig enig

15. I løpet av de siste 4 ukene har jeg snakket med familie og/eller venner om at en bør bruke mindre plastposer.

1. Veldig uenig	2. Uenig	3. Litt uenig	4. Nøytral	5. Litt enig	6. Enig	7. Veldig enig

16. I løpet av de siste 4 ukene har jeg, dersom jeg har sett det, plukket opp plastposer fra bakken og kastet det i søppelet.

1. Veldig uenig	2. Uenig	3. Litt uenig	4. Nøytral	5. Litt enig	6. Enig	7. Veldig enig

Den neste delen vil ta for seg din <u>villighet</u> til å redusere bruk av plastposer i fremtiden.

17. Jeg er villig til å gjøre mitt beste for å redusere mitt personlige forbruk av plastposer.

1. Veldig uenig	2. Uenig	3. Litt uenig	4. Nøytral	5. Litt enig	6. Enig	7. Veldig enig

18. Jeg er villig til å ta med mine egne poser i stedet for å kjøpe plastposer når jeg handler.

1. Veldig uenig	2. Uenig	3. Litt uenig	4. Nøytral	5. Litt enig	6. Enig	7. Veldig enig

19. Jeg er villig til å støtte politiske tiltak (f.eks. avgifter, forbud) som reduserer bruk av plastposer.

1. Veldig uenig	2. Uenig	3. Litt uenig	4. Nøytral	5. Litt enig	6. Enig	7. Veldig enig

20. Jeg er villig til å støtte andre initiativtakere (f.eks. organisasjoner, bedrifter) som jobber for å redusere bruk av plastposer.

1. Veldig uenig	2. Uenig	3. Litt uenig	4. Nøytral	5. Litt enig	6. Enig	7. Veldig enig

Tusen takk for din deltakelse!

Appendix B: Behavioral Observation Sheet (Norwegian version)

SANO customer behaviour observations questions

Give ID (starting from 1) – needs to be the same for both observers

Participant anonymous identifier:

Alternativer i butikk

Type pose	**Ja (1) / Nei (0)**	**Pris**
Plastpose		
Gjenbrukbar pose (bomull eller rPET)		
Andre (esker etc.)		

1. Demografi observert kunde

1.1. Kjønn

Mann	**1**	
Kvinne	**2**	

1.2. Estimert alder

18 - 40	**1**	
Eldre enn 40	**2**	

2. Observasjon av kasserer/butikkpersonale

Observerte elementer	**Ja (1)**	**Nei (0)**
2.1 Kasserer spør om kunde vil ha pose eller et annet alternativ		

2.2 Kasserer skanner varene uten å spørre om pose		
2.2.1. Kunden takker ja til pose		

3. Kundeobservasjon

Observerte elementer	**Ja (1)**	**Nei (0)**
3.1. Kjøpte plastpose **3.1.1**. Hvis ja, hvor mange?		
3.2. Kjøpte gjenbrukbar pose **3.2.1**. Hvis ja, hvor mange?		
3.3. Har med egen pose **3.3.1.** Hvis ja, hva slags?		
Plast		
Gjenbrukbar		
Annet (sekk, eske etc.)		
3.4. Kjøpte plastposer i tillegg til egne poser **3.4.1**. Hvis ja, hvor mange?		
3.5. Kjøpte ikke pose (f.eks. bærer varene i hendene)		

Appendix C: Pre-registration from the project "The human dimension of plastic pollution in South Africa: building capacity to understand and change behavioral drivers and barriers"

The Human Dimension of Plastic Bag Pollution in South Africa (#113247)

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1) Have any data been collected for this study already?

No, no data have been collected for this study yet.

2) What's the main question being asked or hypothesis being tested in this study?

This study primarily uses an exploratory approach under the general assumption that human behavior is a driver of plastic pollution, with a focus on behaviors around plastic bag in South Africa. The study is subdivided into a survey study and field observations.
Survey: Based on previous research we identified a number of drivers and barriers, all of which we expect to have an impact on intended and manifest plastic bag behavior. Specifically, these include habits, social norms, convenience, discomfort, hygienic and practical reasons for plastic bag use, lack of action knowledge, and financial reasons.
Observation: Observation complementing the survey will attempt to identify additional specific, real-world behaviors and structural conditions that foster plastic bag consumption.

3) Describe the key dependent variable(s) specifying how they will be measured.

Survey:
DV 1 : Self-reported plastic-avoidance behaviors, represented by four items
(E.g., "In the last 4 weeks I brought my own bags (cotton, plastic etc.) for shopping.")
DV 2: Intentions to support plastic-avoidance represented by three items
(E.g., "I am willing to support policy regulations that limit the use of single-use plastic bags.")

4) How many and which conditions will participants be assigned to?

This is not an experimental study and thereby no intervention is planned.
Survey: The participants all complete the same questionnaire. Therefore, there are no different conditions.

Observation: The participants are all observed in the same environment, hence belonging to the same condition.

5) **Specify exactly which analyses you will conduct to examine the main question/hypothesis.**

Survey: A sequence of multiple linear regression analyses are planned. In a first step, person indices will be formed for those independent and dependent variables that are recorded with more than one item (i.e., IV: social norms, habits;). Afterwards, a model with and a model without sociodemographic data as control covariates are calculated for all dependent variables. The aim of this analysis is to explain variance in our dependent variables, behaviors and intentions.
Observation: The analysis is descriptive. Cohen's Kappa is calculated to estimate inter-rater-reliability.

6) **Describe exactly how outliers will be defined and handled, and your precise rule(s) for excluding observations.**

Survey: Individuals with too many missing data points (>25%) are excluded from the analysis. Likewise, individuals who revoke their consent to the processing of their data. Finally, as part of the prerequisite check of the regression analyses, data points are inspected and flagged as potential exclusion candidates if they are extreme outliers and high leverage points (Cook's distance and graphical tests are used for this purpose).
Observation: In the case of observation, only those persons are excluded for whom observation could not be carried out completely.

7) **How many observations will be collected or what will determine sample size? No need to justify decision, but be precise about exactly how the number will be determined.**

Survey: Since the models containing the sociodemographic predictors contain a maximum of 15 variables, we were guided by the sample size required for this model. Since this is an exploratory approach, we decided to achieve a sample size that allows us to detect a medium effect (Cohen's f of > 0.15) with a power of $1 - \beta = 0.95$ and a significance level of $\alpha = .01$. G*Power resulted in an N = 252. However, since we have the capacity and more subjects are always desirable in case of regression, as well as predicted dropouts or interviews with crucial missing data, we decided to survey 500 subjects.
Observation: For practical reasons, the observation period is set to one day only (multiple periods). Therefore, we have not set a target number, but the sample size is determined by the circumstances.

8) **Anything else you would like to pre-register? (e.g., secondary analyses, variables collected for exploratory purposes, unusual analyses planned?)**

Survey: No further analyses are planned for the time being. However, if the authors encounter unexpected results, they reserve the right to investigate these further. These results will not be reported as preregistered.

Available at https://aspredicted.org/xy472.pdf

(Permanently archived at http://web.archive.org/web/*/https://aspredicted.org/xy472.pdf)

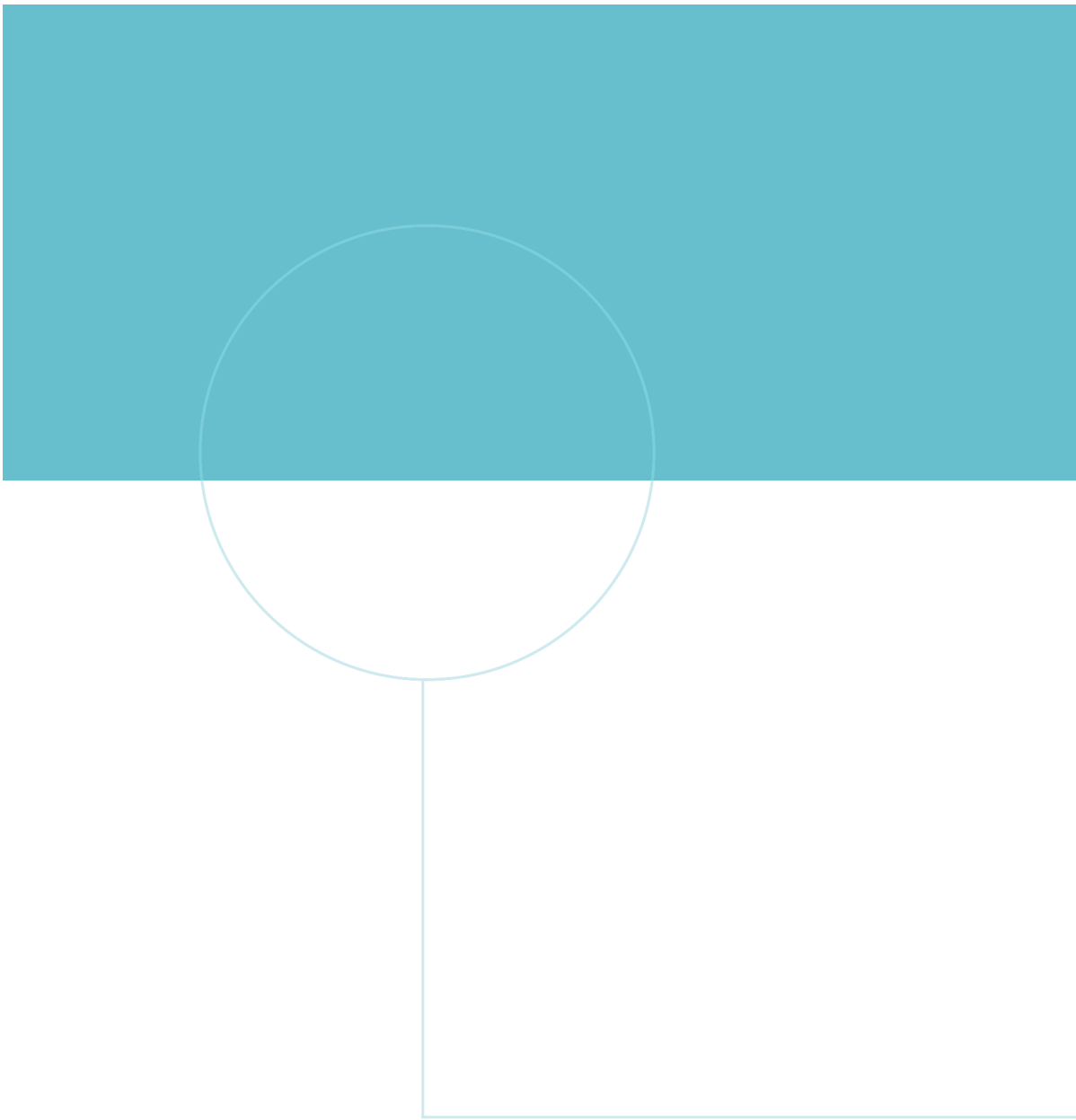
Version of AsPredicted Questions: 2.00

Appendix D: Additional analyses

Table D 1: Correlation matrix for survey items

Variable	1	2	3	4	5	6	7	8
Habits	-							
Social norms	-.27*	-						
Behavior	-.35*	.35	-					
Intentions	-.39*	.50	.45	-				
Conformity	.21	.06	.08	-.00***	-			
Cost	-.18*	.23	.31	.21	.08	-		
Convenience	.49	-.27*	-.28*	-.39*	.11	-.01**	-	
Perceived behavioral control	.32	-.03*	-.01**	-.08*	.27	.04*	.23	-

Note. N=524. *** $p < .001$, ** $p < .01$, * $p < .05$.



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