Exploring perceptions of household surface cleaning products and the implications for sustainable consumption

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The candidate confirms that the work submitted is her own and that appropriate credit has been given where reference has been made to the work of others.

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Abstract

Historically, green cleaning products have performed poorly in comparison with conventional alternatives. Other green product categories are rising in popularity while green cleaning products remain unfavourable. Consumers may view green cleaning products negatively because they believe that green products cannot be as strong as conventional products. This has only been tested in hypothetical products. Consumers also view green cleaning products as safer than conventional cleaning products. This thesis explores these perceptions by answering the following research questions:

1. Are there differences in the composition of green and conventional cleaning products? If so, do these differences have implications for health and the environment?

2. Does a product's environmental status influence how the product is perceived by consumers in terms of its effectiveness?

3. Does a product's environmental status influence how the product is perceived by consumers in terms of its safety?

4. Does a product's environmental status influence the way in which its ingredients are perceived by consumers?

Firstly, a comparison of ingredients was made using publicly available information. Secondly, a novel experimental study was used to compare perceptions of product efficacy. Finally, an online survey was utilised to explore perceptions of product and ingredient safety. There are no differences between green and conventional cleaning products in their potential harm to human health. Negative quality perceptions of green household cleaning products are not present for existing green cleaning products. Consumers struggle to identify green cleaning products, but those who correctly identify green cleaning products perceive them as safer for health than conventional products. There were no perceived differences in ingredient safety between green and conventional products. This research contributes an original methodology by exploring perceptions in real over hypothetical products, and outlines principles that future research must follow.

Table of Contents

List of Figures

List of Tables

1. Introduction

The following section will serve to ground this research in the appropriate context. Following this, research questions will be stated and defined. Finally, the structure of the remainder of this thesis will be outlined.

1.1. RESEARCH CONTEXT

1.1.1. Sustainable consumption and green products

Consumption refers to "the acquisition, use and disposal of products… services…and practices" (Bagozzi, Gurhan-Canli, and Priester, 2002, p1). In 1992, the United Nations stated that the current levels and patterns of consumption and production in industrialised nations are unsustainable and a key cause of environmental degradation (Cooper, 2000). Consumer behaviour therefore has implications for resource consumption and broader environmental issues, and as a result growing importance is placed on the need to consume sustainably. Ofstad et al. (1994) define sustainable consumption as the use of items and services that respond to fundamental needs and result in an increased quality of life. Sustainable consumption reduces the usage of natural resources, toxic ingredients and emissions of waste and pollutants over the lifecycle, so as not to compromise the needs of future generations (Ofstad et al, 1994). There is still debate as to whether this involves consuming less harmful products, or consuming fewer products overall (Cooper, 2000). A thorough discussion of this debate is beyond the scope of this thesis; however there are some product categories that most consumers would regard as necessities. As such, opportunities for reducing the consumption of these products will be limited, as consumers will feel the need to purchase or repurchase these as required. It is argued that cleaning products belong to this category, due to the need for a clean home to reduce the spread of infectious disease and to fulfil social norms. Furthermore, most industrialised Western nations are capitalist societies that prioritise continuous economic growth; encouraging citizens to radically reduce consumption behaviour is unlikely to achieve popularity with governments or consumers alike (Cooper, 2000). Thus, efforts have been made by manufacturers to create products that have a reduced environmental impact in a bid to allow for a reduction in environmental deterioration while maintaining current consumption patterns. These products are often referred to as green, sustainable, environmental, environmentally friendly or eco-friendly products. For the purpose of this research, the term green product will be adopted.

Creating an all-encompassing definition of a green product is worthy of a thesis in itself; Durif et al. (2010) highlight that definitions of green products are unclear, with poorly defined boundaries and a lack of consistency across the literature. Ottman (1998, p89) notes that green products can only be defined in relation to conventional products; every product will have some form of environmental impact as all products "use up energy and resources and create by-products and emissions during their manufacture, transport…usage and eventual disposal". Thus, a green product can only be a green product in comparison to a non-green product (referred to throughout this work as a conventional product). The purpose of this research is not to define green products, and as such will adopt the widely used definition put forth by Peattie (1995, p181), who believes a green product to be one whose "environmental and societal performance in production, use and disposal, is significantly improved and improving in comparison to conventional or competitive products offerings".

Historically, green products have occupied a niche segment of the market, previously limited to specialist shops that only highly motivated self-proclaimed green consumers would seek out (Chintakayala et al., 2018). Such consumers were likely to be highly engaged with environmental issues and possess a fundamental understanding of what makes a product environmentally preferable. However, over recent years green products have been penetrating mainstream markets and are now often available in supermarkets alongside conventional products (Chintakayala et al., 2018). Thus, green products are available to a wider range of consumers and therefore have the possibility for widespread adoption. However, the majority of these consumers are unlikely to possess a detailed understanding of environmental issues. Furthermore, environmental performance is unlikely to be the sole deciding factor for purchasing decisions made by the majority of consumers. In order for sustainable consumption to truly break the mainstream, it is important to find a way to successfully encourage the majority of consumers to select green products.

1.1.2. Cleaning, cleanliness and cleaning products

It is important to briefly acknowledge and understand what cleaning is, why it is performed and why it is important. Cleaning falls under the remit of housework; housework is defined as a “set of unpaid tasks…to maintain the home and the families possessions” (Lachance-Grzela and Bouchard, 2010, p769). Largely, housework is viewed unfavourably and is performed mainly by women (Davis and Greenstein, 2013). Household cleaning is performed to increase the aesthetic appeal of the home and environment, to remove stains and soil and to achieve sufficient levels of home hygiene (Terpstra, 2001). It is a mixture of domestic work and consumption belonging to the domain of ordinary consumption; consumption practices that ‘have become so mundane, so taken for granted, so normal, that most people…fail to appreciate their significance’ (Gronow and Warde, 2001, p4; Martens and Scott, 2005).

Prior to the 19th century, motivations for cleaning were largely religious. Nobody had time to complete regular and routinized cleaning tasks. Instead, cleaning was carried out as part of winter and midsummer rituals that closely followed religious calendars (Berner, 1998). Cleaning was an act that allowed individuals to be perceived as pure in the eyes of gods (Terpstra, 1998). However, towards the end of the 19th century, it was discovered via germ theory that home hygiene plays an important role in the reduction of infectious disease transmission (Terpstra, 1998; Terpstra, 2003). As such, the early 20th century brought with it a craze of cleaning and home hygiene is now perceived as closely linked to good housekeeping. While the morality associated with cleaning was previously linked to religion, it now became associated with reducing the risk of disease. This association lead to the formation of a new social norm surrounding cleanliness (Woersdorfer, 2010). A clean home signalled competence, respectability and social distinction.

Thus, anyone who did not maintain a clean home was immoral and posed a risk to society (Berner, 1998). Nature was perceived as intimidating, bringing with it threats to health and possessions. Thus, everything natural was viewed with distrust; the woman's job was to impose order and rule over nature by maintaining an odourless, dustless and spotless home (Martens and Scott, 2006; Berner, 1998). It is also important to consider the context of early 20th century life as a woman; employment opportunities were few and the majority of women were reliant on their husbands' earnings and good will. A woman's role was to provide the husband with a place of sanctuary via a clean, ordered and tidy home. Failure to provide this risked collapse of the entire home, household harmony and abandonment of the wife by the husband (Berner, 1998). Failure to maintain a clean home thus posed severe threats to both bodily and marital health. As a result, cleanliness permeated the housewife's every thought and habit, and the importance of keeping the home clean was passed down generations from mother to daughter (Berner, 1998).

A more modern history of cleaning in society is provided by Martens and Scott (2005), in their review of Good Housekeeping magazine from 1951-2001. As more women moved into the workforce, cleanliness in the home suffered to the point where it was recognised by the Prime Minister as an urgent problem requiring action. This led to the creation of a host of new products designed to make cleaning as easy and manageable as possible, furthering the role of consumption in cleanliness. This may have reduced the physical demand of cleaning but with it introduced a new level of mental labour. As well as carrying out the cleaning, women now had the difficult task of deciding between vast ranges of products that have only increased over time. Furthermore, as our understanding of germs increased, as did the tasks required to suppress them. With bacteria being invisible to individuals, the only way to alleviate anxieties surrounding cleanliness was to endlessly repeat cleaning tasks. The 'appearance of clean' also took on increasing importance. Cleanliness is portrayed as the absolute ideal; in order to live a better life, consumers must be cleaner (Jack, 2018). Thus, the cleaner one is, the better their life must be. Perceptions of dirt are subjective across individuals, classes and time periods, but homes and surfaces absent of any dirt whatsoever are perpetuated as the only acceptable standard (Jack, 2017). The aesthetic of the home and a good appearance and smell became the end result of cleaning itself. A clean odour became synonymous with cleanliness; initially this was a chemical odour made popular by the brand Dettol, but this was soon replaced with floral and citrus scents. Thus, symbolisms of cleanliness such as sparkling surfaces and pleasant scents became of greater importance than the act of cleaning itself (Martens and Scott, 2005).

As the impact of infectious diseases lessened in Western society, greater emphasis was placed on the risks posed by the chemicals contained in cleaning products over the risks of the germs and bacteria that these products are designed to eradicate (Martens and Scott, 2006). Furthermore, these appeals are often discussed in relation to the female role of being a mother by suggesting potential harm to children. Products that were once touted as imperative for the hygiene of the home are now described as dangerous mixtures of chemicals posing risks to familial health (Martens and Scott, 2005). Older cleaning practices once banished as out-dated and ineffective were now encouraged due to posing less of a risk to the body and health. Features on environmental issues and advertisements for green products appear from 1981, linking fears to health with the environmental status of products. 1991 saw the introduction of a 'Good Earthkeeping' feature within the magazine, highlighting the connection between an avoidance of harmful chemicals with caring for the domestic environment. Caring for the family involves caring for the domestic setting surrounding them; the matriarch must carefully balance the protection against infectious disease with protection against dangerous chemicals. The home is portrayed as both a safe refuge and a dangerous place and it is the job of the domestic practitioner to correct the balance. This is paired with an ever-increasing number of products available to choose between. Assessing the comparative safety of these products adds to the difficulties of running a safe household (Martens and Scott, 2006, 2005).

Thus, modern domestic life is increasingly complex. Women are still largely responsible for the everyday cleaning of the home, but are working more than they ever have (Davis and Greenstein, 2013). There is still a cultural imperative to maintain a clean home, and an endless range of products to achieve this with (Jack, 2018, 2017; Martens and Scott, 2005). Unclean homes and surfaces pose risks via bacteria and infectious disease, but the products designed to eradicate these bacteria pose risks via the chemicals they are composed of. Women's roles as mothers are exploited in order to heighten these anxieties, as both the diseases and chemicals risks to children are emphasised. Thus, women have less time to clean but more products to choose between, and each of these products must be evaluated in terms of their ability to reduce the spread of germs as well as their chemical risk to safety. The International Scientific Forum on Home Hygiene state that the need to address this balance between the health benefits of cleaning and the risks posed to the environment and human health by cleaning products is a key barrier towards the widespread adoption of home hygiene as a public health policy (Bloomfield et al., 2018). This is the context in which the current research sits.

1.1.3. Legislation surrounding chemical-containing products

A complex network of laws and legislatures exist regarding chemical-containing products. Recent changes to these have been introduced by the European Union[1]. These changes increase the importance placed on assessing the impact of widely used chemicals on human health and the environment. Regulation (EC) No 648/2004 states that producers of cleaning products must also provide a full list of ingredients within their products on a corresponding website. The website address must be provided on the product's packaging. Fragrance ingredients are those that are contained in products in order to provide the product with a pleasant aroma. Regulation (EC) No 648/2004 also states that any fragrance ingredients that have been identified as potential allergens must be clearly indicated in the product ingredient list. Prior to this, manufacturers have simply been able to state 'fragrance', 'perfume' or 'parfum' as a cover-all term for fragrance

1 While the dates of these legislations may not classify as 'recent', it has taken time to implement each of them. For example, Regulation (EC) 1272/2008 was not compulsory for mixtures until 2015. Thus, the combined implementation of these regulations is regarded as recent by the author.

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ingredients[2]. Thus, there is some publicly available information regarding the chemicals contained in cleaning products.

All chemicals contained in consumer products are to be registered with the European Chemicals Agency (from here on to be referred to as ECHA). Furthermore, the onus is on chemical manufacturers to conduct safety testing and provide information to ECHA regarding a chemical's potential risk to human health and the environment (REACH: Regulation (EC) No 1907/2006). Regulation (EC) 1272/2008 focuses on harmonising the classification, packaging and labelling of dangerous substances. This regulation categorizes all hazards a chemical could pose, with subcategories for each depending on severity. Based on this, a chemical must then be labelled accordingly before it can be sold or included in a product that is then placed on the market. Depending on the severity of the hazards posed by the chemical, the labelling may need to contain: a pictogram, a signal word, a hazard statement and a precautionary statement. A pictogram is the pictorial representation of the hazard the chemical poses – for example, a flame for a chemical that is flammable. A signal word indicates the severity of the hazard; 'Danger!' is more severe than 'Warning'. The hazard statement refers to the hazard itself; e.g. 'Causes serious eye damage'. The precautionary statement is a phrase that describes recommended risk reduction behaviour, such as 'Wear eye protection'. This is in relation to the chemical itself. At a product level, if a product contains a chemical deemed to be hazardous at a particular concentration, the chemicals name must be stated in the ingredient list and the corresponding pictogram, signal word, hazard statement and precautionary statement must be present on the product label (European Parliament and Council, 2008). The concentration at which the chemical must be present in the product before a label is required depends on the severity of the hazard posed by the chemical[3].

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[2] Fragrance ingredients that are not on this list of allergens can still be listed as this.

[3] For a detailed overview of this, readers are referred to the CLP guidance document produced by the European Chemicals Agency (European Chemicals Agency, 2015). The criteria required for each different classification are incredibly lengthy and complex and it is impossible to succinctly summarize them here.

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These changes in legislature mean that as well as publicly available information regarding cleaning product ingredients, there is also publicly available information regarding the hazards posed by these ingredients to human health. This forms the basis for much of the current research.

1.2. RESEARCH QUESTIONS

It is important to note the interdisciplinary nature of this project; it asks and answers questions that span across the disciplines of sustainability science, chemistry, toxicology, psychology and marketing. In order to do so, it consists of three methodologically separate pieces of research that link together thematically. The work in this thesis ties in multiple different streams of research that until now have only been explored in isolation. It is argued that by exploring the topic from a multidisciplinary perspective, a much fuller picture of the research area will be provided. Using the theoretical framework of the sustainability liability, this thesis attempts to answer four main research questions, along with a subset of hypotheses. These are as follows:

1. Are there differences in the composition of green and conventional cleaning products? If so, do these differences have implications for health and the environment?

    i. *That there will be differences in the associated environmental and human health hazards between conventional and green cleaning products.*
    ii. *That there will be differences in the associated environmental and human health hazards between the different functions of ingredients contained within cleaning products.*
    iii. *That there will be differences between the number of different functional ingredients contained in green and conventional cleaning products.*
    iv. *That there will be ingredients contained in both types of products that may pose a particular concern.*

2. Does a product's environmental status influence how the product is perceived in terms of its effectiveness?

i. *Participants will rate green products lower when they are aware that they are using a green product compared to when they are not aware of which product they are using.*

ii. *When participants are aware that they are using a green product, they will be willing to pay significantly less for it than when they are not aware that they are using a green product.*

iii. *When participants are aware that they are using a green product, they will use significantly more of it than when they are not aware that they are using a green product.*

iv. *When participants are aware that they are using a green product, they will take significantly longer to clean than when they are not aware that they are using a green product.*

v. *These relationships will be influenced by whether the participant values environmentally friendly attributes in a product.*

vi. *These relationships will be influenced by whether the participant values strength attributes in a product.*

vii. *Participants will be significantly more likely to select a green product when they are not aware of which products they are using compared to when they are aware of which products they were using.*

3. Does a product's environmental status influence how the product is perceived in terms of its safety?

i. *When individuals are aware that a product is marketed as green, they will rate it lower in terms of perceived harm to human health from the overall product.*

ii. *When individuals are aware that a product is marketed as green, they will rate it lower in terms of perceived harm to the environment from the overall product.*

4. Does a product's environmental status influence the way in which its ingredients are perceived?

i. *When individuals are aware that a product is marketed as green, they will perceive the ingredients the product contains to be less harmful to human health.*

ii. *When individuals are aware that a product is marketed as green, they will perceive the ingredients the product contains to be less harmful to the environment.*

iii. *This relationship will be moderated by individuals' pro-environmental attitudes.*

1.3. STRUCTURAL OVERVIEW

The thesis will be structured as follows. Firstly, an overall literature review will be provided. This will provide the background and rationale for the research. The subsequent three chapters will present each piece of research, with their own smaller and more focused literature review and discussion. Chapter 3 will address research question 1 through a comparison of the ingredients contained in green and conventional cleaning products. Chapter 4 will address research question 2 through an experiment whereby participants use green and conventional cleaning products. Chapter 5 will address research questions 3 and 4 through an online survey that explores perceptions of product and ingredient safety. Following this will be a broader discussion chapter, considering each of the pieces of research in relation to both each other and the wider literature. It will also reflect on the strengths and limitations of the overall research and outline suggestions for future research. A short conclusions chapter will follow. Following this will be a references and appendices section.

2: Literature review

The following chapter will provide a review of literature relevant to the topic of interest. As this project spans across multiple disciplines, numerous streams of literature will be introduced and reviewed. Firstly, an overview of green marketing will be provided. Secondly, barriers to sustainable consumption and the attitude-behaviour gap will be discussed, focussing on price, lack of information and quality perceptions. Following on from this will be a detailed review of cleaning products, their ingredients and implications for the environment and human health. Thirdly, the context in which consumers make purchasing decisions will be considered. Finally, this chapter will end by discussing the ways in which a consumer may use a product's environmental status as a decision-making heuristic. Throughout this chapter, relevant gaps in the literature will be identified.

2.1. GREEN MARKETING AND THE GREEN CONSUMER

2.1.1. Marketing and green marketing

Grönroos (1990) defines three core concepts of marketing: the philosophy that the entire organization is guided by, a way in which to organise company activities and functions, and a set of tools and techniques used to encourage consumers to select the offerings of their company over competitors. Kotler (1999, p. 4) perceives marketing to be "a societal process by which individuals and groups obtain what they need and want through creating, offering and exchanging products and services of value with others". There are two different views of marketing; the first would perceive marketing as a tool that persuades people to buy items that they do not need, thus contributing to and causing overconsumption (Jones et al., 2008). In this way, marketing can be seen as the complete antithesis of sustainable consumption as it is based on a model of continuous consumption without acknowledging environmental limits to growth (Kemper et al., 2019; Kemper and Ballantine, 2019). The second view of marketing is more amenable to sustainable consumption; marketing as the process by which consumer needs are identified and met in a way that is profitable to the company (Jones et al., 2008). If a consumer need for more sustainable product options is identified then marketing can be used to meet this need. During the 1980s, a rapid upsurge in green consumerism was predicted that indicated a drastic shift towards green products was inevitable (Prothero, 1990). Swathes of consumer research reported increased environmental awareness, an interest in environmentally-preferable products and – arguably most importantly – a pronounced willingness of consumers to pay a premium price for such products (Peattie and Crane, 2005). From this, the field of green marketing has emerged.

Peattie (2001, p. 141) defines green marketing as “the holistic management process responsible for identifying, anticipating and satisfying the needs of customers and society, in a profitable and sustainable way”. In response to reported consumer needs, companies developed increasing amounts of green products (Chen and Yang, 2019). However, the development of these products is of limited benefit unless they become widespread in the market and adopted by a large number of consumers (Dangelico and Vocalelli, 2017). Despite the initial promise reported in the late 1980s, the following decade did not bring about the extensive shift towards green products that was initially predicted (Peattie and Crane, 2005). Thirty years later, many green product categories still struggle to achieve mainstream success (Luchs et al., 2010). As such, understanding the ways in which these products have been and should be advertised to consumers is of great importance when considering the implications that green products can have for sustainable consumption. Thus, the following sections will explore green marketing strategies, how traditional marketing practices have been applied to green products and the limitations of green marketing.

2.1.2. Green marketing strategies

Kotler and Armstrong (2014) suggest four different steps towards a marketing strategy: segmentation, targeting, positioning and differentiation. The following section will consider these steps in relation to green marketing. It is thematically appropriate to discuss segmentation and targeting in combination with each other, as well as positioning and differentiation (Dangelico and Vocalelli, 2017) .

Segmentation involves identifying the group(s) of consumers that a product or service should serve. Targeting refers to the process of tailoring the product or service to these consumers (Dangelico and Vocalelli, 2017). As such, much research into green marketing has focused on identifying ‘the green consumer’ in order to identify the segment of consumers that green products should be targeted towards. Earlier research focused largely on demographic or socio-demographic variables such as age (Buttel, 1979; Roberts, 1996), gender (Davidson and Freudenburg, 1996; Hunter et al., 2004; MacDonald and Hara, 1994; Schahn and Holzer,1990) , education (Granzin and Olsen, 1991; Kinnear et al., 1974; Roberts, 1996) and income (Berkowitz and Lutterman, 1968; Plummer, 1974). Schultz et al. (1995) suggest that the green consumer is younger, female, well educated, high-earning, home-owning, politically active, liberal and active within the community.

Straughan and Roberts (1999) note that while the green consumer is largely thought to be young, female, well educated and with a high level of income, research into these variables is often contradictory or inconclusive. Wagner (1997) suggests that for every study confirming the effect of one demographic variable, there will be another disconfirming it. Bhate and Lawler (1997) find that demographic variables are the weakest predictor of pro-environmental behaviour. More recent research suggests that while socio-demographic variables may be useful for profiling consumers high in environmental knowledge and attitudes, they have limited applicability for environmental behaviours including green product purchasing (Diamantopoulos et al., 2003). As McDonald and Oates (2006) report, the green consumer has been suggested to be older and younger and both male or female. Thus, Peattie (2010) concludes that the only consistency within demographic segmentation research is the inconsistencies between the results. As such, much of the research into green consumer segmentation has moved away from demographics and towards psychographic variables.

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Straughan and Roberts (1999) provide an initial exploration of psychographic variables that may influence green consumerism, suggesting that green consumers are more likely to be politically left wing, high in altruism and environmental concern and believe that their actions can make a difference (perceived consumer effectiveness). Other variables that have been explored include: environmental knowledge (Bartkus et al., 1999; Davies et al., 2002), environmental attitudes (do Paço et al., 2013; Laroche et al., 2001), locus of control (Kollmuss and Agyeman, 2002), affinity with nature (Hartmann and Ibáñez, 2006) perceived threat, trust (Barr and Gilg, 2007), self-identity (Fekadu and Kraft, 2001) and personality factors (Fraj and Martinez, 2006) among others – all with varying results. To comprehensively review each of these variables and their impact on green consumption behaviour is beyond the scope of the current research. However, the sheer number of psychographic variables that have been found to have some effect on green purchasing behaviour is listed here to suggest the limited applicability and usefulness of green consumer segmentation and targeting. If companies attempted to segment and target based upon all of the individual variables that have been found to potentially influence green consumerism, they would find themselves with a small yet confused target audience.

A further stream of research moved beyond segmenting characteristics of the consumer and onto the characteristics of the purchase itself. This was on the basis of Kardash (1974, p. 1269), who stated that "according to which a rational consumer that chooses for his/her own good, in front of two goods, absolutely identical, differentiated only for an environmental feature, will buy the one with better environmental performance". With green products performing more poorly than predicted, it became clear that green and conventional products may not always be absolutely identical apart from environmental performance. Thus, as opposed to identifying a basis of consumers who would always select a green product, Peattie (1999) reclassified consumption as a set of individual purchases that may be inconsistent between product types, categories and over time. It therefore becomes important to segment between the situational factors that may encourage or discourage a green purchase decision. McDonald and Oates

(2006) suggest that generally, consumers will always be predisposed to favour sustainable products over traditional ones. However, qualities such as price, brand and availability compete with environmental criteria and limit green purchase behaviour. This will be explored further in Section 2.4.

Positioning and differentiation refers to the image that the company or product conveys to consumers, and how this sets them/it apart from their competitors (Arseculeratne and Yazdanifard, 2013; Dangelico and Vocalelli, 2017). If a company is boasting a green product, they are more likely to be successful if the company itself is perceived as green (Prakash, 2002). Thus, it is therefore not enough to simply advertise the green features of a product; the company or brand themselves must ensure that sustainability is present across all public business operations in order to increase green brand image and trust (Chen and Chang, 2012; Chen, 2010; Polonsky and Rosenberger, 2001). Hartmann et al. (2005) suggest that green products can be positioned and thus differentiated from conventional products through their qualities, which can be either their functional or emotional attributes. Functional attributes refer to the superior environmental benefits of the product (Peattie, 1995). Emotional benefits are more tangible to the consumer as they relate to a direct personal benefit, through either an increased sense of wellbeing from acting altruistically, the purchase of a green product as a status symbol that outwardly displays an individual’s self-identity (Belz and Dyllik, 1996; Griskevicius et al., 2010) or the benefits that come with feeling closer to nature (Kals et al., 1999). Companies may emphasise any of these benefits in order to differentiate their products from others.

2.1.3. The marketing mix and its application to green products

The marketing mix refers to the concept of ‘The 4Ps’, originally introduced by McCarthy (1964). The 4Ps refer to four marketing elements: product, price, place and promotion. If properly managed, these four elements would result in a successful and profitable business. This concept has since come to dominate the marketing literature, and as such has found itself being applied to the field of green marketing (Dangelico and Vocalelli, 2017). Chan et al.

(2012) note that in green marketing mixes, satisfying pro-environmental and societal needs is valued more heavily than traditional marketing mixes. Kinoti (2011) describe green marketing mixes as consisting of green product development with pricing, promotional and distribution strategies focusing on satisfying environmental needs. Davari and Strutton (2014) suggest that the green marketing mix elements are important predictors of green brand loyalty.

It is important to note, however, that the marketing mix is not without it's limitations. Constantinides (2006) provide an excellent overview of these. The marketing mix was initially developed in the 60s, at a time when mass marketing for consumer goods was both common and appropriate. As such, it advocates for a somewhat 'one size fits all' approach that fails to respond to individual consumer needs or foster long term consumer relationships (Lauterborm, 1990; Rosenberg and Czepiel, 1992). Consumer behaviour is shifting; consumers now have increased choice, greater access to information, an access to global products and diminished brand preference (Constantinides, 2006). The modern marketing environment is highly competitive, dynamic and technology mediated (McKenna, 2003) and as a result of this, responding to individual consumer needs and developing positive and long-term consumer relationships is increasingly important. The marketing mix has thus been criticised for it's internal orientation and lack of personalisation, and its application to modern marketing approaches is often questioned (Constantinides, 2006; Kotler, 1984, Schultz, 2001). However, as will be explored in Section 2.2, elements of the marketing mix can also act as barriers towards the purchase of green products. This therefore provides a useful framework for exploring the different elements of green marketing, but these limitations should be considered throughout the remainder of this section.

Green products and their definitions were discussed in Section 1.1.1. The most common production strategies for green products include: using recycled elements, ability to reuse the product or part of it, decreasing the amount of packaging, making products both more durable and repairable, using compostable materials or making the products healthier and safer in shipment (Kinoti, 2011; Mishra and Sharma, 2014). These qualities must be made both valuable and tangible to consumers, often achieved through their packaging (Dangelico and Vocalelli, 2017). Dangelico and Pontrandolfo (2010) suggest that green product features could be advertised to consumers based on their life cycle phases by highlighting the different green features before, during and after use.

Green prices refer to the fact that green products are largely more expensive than their traditional counterparts, often due to increased material and production costs (Arseculeratne and Yazdanifard, 2013; Peattie and Crane, 2005). However, sometimes the higher price of green products can arise due to the higher perceived value that companies believe green products offer (Chan et al., 2012). Previous research has suggested that consumers are willing to pay more for green products (Casadesus-Masanell et al., 2009; Sammer and Wüstenhagen, 2006). Michaud and Llerena (2011) find that willingness to pay an increased price for green products is dependent on the qualities of the green product itself. Remanufactured or recycled parts in a product negatively impacted consumer willingness to pay. Freestone and McGoldrick (2008) indicate that while consumers are willing to pay more for a green product, there is an ethical critical point that acts as a ceiling to this willingness to pay. Beyond this point, the financial sacrifice outweighs the environmental benefits offered by the product. Thus, green pricing strategies must carefully balance the willingness to pay more for green products with consumer sensitivity to price, along with an awareness of product category (Dangelico and Vocalelli, 2017; Essoussi and Linton, 2010; Grove et al., 1996). Price will be discussed further in section 2.2.1.

Green place refers to the management strategies involved in distributing green products from production to the point of consumption (Davari and Strutton, 2014). Availability of green products is often cited as a barrier towards their purchase (Gleim et al., 2013). Thus, companies must carefully consider how and where their products are sold. Lampe and Gazda (1995) note the early trend of opening specialist environmental stores for the distribution of green goods, but the majority of consumers do not actively search for green products. Thus, specialist distribution of green products is unlikely to be a satisfactory option and manufacturers of these products must make them available where the majority of consumers shop (Mishra and Sharma, 2014). As a result of this, many green product options are now available alongside their conventional counterparts in mainstream stores such as supermarkets (Chintakayala et al., 2018). Such products will be the focus of this research.

Green promotion can be viewed as the way in which companies persuade consumers that a) selecting green products is beneficial to the environment and b) selecting their product in particular is the best method to achieve these environmental benefits (Davari and Strutton, 2014). Specifically, Banerjee et al. (1995) note that green promotions must fulfil one or more of three green criteria. Firstly, they must show the relationship between the product and the biophysical environment. Secondly, they must advocate green lifestyles, either with or without recommending a particular product or service. Finally, they should present, improve or maintain green corporate images. Arseculeratne and Yazdanifard (2013) report that the most effective green promotions are those that result from identifying and utilising the correct means, channels and messages at the right time to communicate with the correct group of consumers. Pranee (2012) denotes the increasing quantity and impact of advertising in people's lives; Purohit (2012) suggests that consumers largely view this favourably when it involves green products. However, consumers do not have a thorough understanding of all environmental terms and issues and thus environmental advertising must be complete, clear and easy to understand (Smith, 2014; Testa et al., 2015). Early research into green promotions provides a number of recommendations: technical terms must be defined, targeted and real. Valuable green claims should be favoured over vague messages. The advertised benefit should have clear impacts and these benefits must be validated using specific data (Davis, 1993). More recent research has built on this to suggest that green promotions should also have a clear associated message (Pranee, 2010), be easy to remember and understand (Bickart and Ruth, 2012) and generate emotional commitment (Hartmann and Ibáñez, 2013). Typically, green promotions play the most significant role in green marketing strategies as they must convey the green product features while also justifying the premium price (Davari and Strutton, 2014).

2.1.4. Limitations and criticisms of green marketing

Peattie and Crane (2005) provide a thorough overview of the limitations and criticisms of green marketing. While their research may be perceived as somewhat dated, it is argued that these criticisms provide much of the context for the difficulties faced by modern day green marketing. They define five failed manifestations of green marketing: green spinning, green selling, green harvesting, enviropeneur marketing and compliance marketing. It is beyond the scope of this research to exhaustively list and review all limitations and criticisms of green marketing. Of particular interest to the current research are that of green selling and enviropeneur marketing, as well as the closely related concept of green marketing myopia (Ottman et al., 2006).

Green selling is the unfortunate by-product of the reported market shift towards green consumerism that emerged in the late 1980s; companies assumed that environmental attributes would result in easy sales, often at a higher price (Peattie and Crane, 2005; Prothero, 1990). Thus, they were quick to re-advertise existing products with newly added green claims in an attempt to boost sales. This forms the basis for greenwashing, whereby companies advertise strong environmental performance without an evidence base to substantiate it (Delmas and Burbano, 2011; Peattie and Crane, 2005; Yadav and Pathak, 2013). Alevizou et al. (2015) find that unsubstantiated green claims with environmental imagery and taglines such as ‘earth-friendly’, ‘ecological product’ and ‘environmentally safe’ are perceived as vague and misleading. Such false and meaningless claims have resulted in growing consumer scepticism and suspicion regarding green companies and lower purchase intention towards their products (Albayrak et al., 2011). Furthermore, these negative emotions transfer onto products that have been certified as environmentally preferable, and onto the certification logos themselves (Alevizou et al., 2015).

Enviropeneur marketing, as coined by Peattie and Crane (2005), is the process by which dedicated individuals or companies aim to bring novel green products to the market. Emboldened by the early wealth of research suggesting an urgent consumer need for green products and services, smaller firms producing only green products arose within the market. Ecover – a green cleaning product brand – are cited as an example of this kind of boutique enviropeneur marketing (Peattie and Crane, 2005). While attempting to respond to the consumer need for green products, other consumer needs were ignored.

Sharma and Iyer (2012) find that most consumers do perceive trade-offs between environmental qualities and other product qualities, but are willing to accept green products as long as they reach a satisfactory level of performance on other attributes. Peattie and Crane (2005) argue that the knowledge that consumers require green products does not outweigh the need for knowledge as to what trade-offs on other attributes are considered acceptable. In the case of enviropeneur marketing, this was often overlooked. As a result, products were produced that left consumers confused and disappointed by their performance – washing detergents that did not leave clothes white, due to the exclusion of optical brighteners, or washing up liquids that did not provide an adequate amount of foam (Peattie and Crane, 2005). This concept is often referred to as green marketing myopia, whereby environmental quality is misjudged or overemphasised over customer satisfaction (Ottman et al., 2006). The result of this is negative quality perceptions of green products that still linger today. Tseng and Hung (2013) explored the gap between expectations and perceived quality of green products, finding that many green products are lacking in functional performance and sensory aspects. These negative quality perceptions form the bulk of the current research, and will be explored in further depth in this chapter in Section 2.2.3.

A further – but not final – limitation of green marketing that bears consideration is that it is only pursued for as long as there is a business case for sustainability. Marketing has been described as the antithesis of sustainable development due to its roots in consumerism and materialism (Kemper et al., 2020; Kemper and Ballantine, 2019). Much of the research into green marketing emphasises the cost reductions, new markets and competitive advantages it can bring to a company as opposed to the need to act in order to protect the environment (Kemper and Ballantine, 2019). As described best by Luke (2013, p. 86) “Ecological awareness has been treated, like most virtues in a capitalist marketplace, as an individual taste rather than a social necessity”.

In this way, green products are developed and marketed in order to attract a wider range of consumers and thus bring greater profit to the company. As such, many business approaches to green marketing have been conservative in nature, focused only on incremental adjustments to existing products and processes and thereby avoiding meaningful change (Peattie and Crane, 2005). From a consumer perspective, Smith (1998) argues that green marketing simply plugs the gap between individual concern for the environment and the wish to sustain a consumerist lifestyle. Concerned individuals can purchase a green product option and reward themselves for making their contribution towards protecting the environment without having to make any real or meaningful change (Peattie and Crane, 2005). Is it truly possible to address the problems of overconsumption through consumption in a different form? While these are valid criticisms, it is important to acknowledge the contextual constraints in which the current research operates. The current research takes place in a Western and capitalist society that prioritises continuous economic growth; efforts to radicalise the notion of sustainable consumption beyond green products and services are unlikely to break the mainstream (Cooper, 2000). Thus, the current research pursues the widespread adoption of green products while recognising the limitations of this approach in the wider context of sustainability. This should be held in mind throughout the remainder of this thesis.

2.2. BARRIERS TO SUSTAINABLE CONSUMPTION AND THE ATTITUDE-BEHAVIOUR GAP

The attitude-behaviour gap is a well-documented phenomenon that refers to the fact that individuals do not always act in line with their stated intentions (Young et al., 2010). With regards to sustainability, 89% of individuals state concern for the environment and hold pro-environmental attitudes (Carrington et. al, 2014). In response to these stated attitudes, firms are spending more on producing green products. For example, green cleaning products have been identified as a key market growth opportunity within the cleaning product sector (Keynote, 2014). However, of this 89%, only 30% of these individuals then translate their pro-environmental attitudes into tangible purchase intentions towards green products (Carrington et al., 2014). In spite of this, the market share for green products is only 4% worldwide (Gleim et al., 2013). Models of behaviour that use sustainable intentions as a direct predictor of sustainable behaviour are wrong 90% of the time (Carrington et al., 2010). Only 3% of consumers with sustainable purchase intentions actually purchase sustainable products (Essoussi and Linton, 2010). This highlights a clear gap between stated consumer attitudes and actual purchasing behaviour. This is known as the attitude-behaviour gap; a widely studied yet poorly understood concept. Understanding the attitude-behaviour gap is fundamental to sustainable consumption. Much research focuses on pro-environmental attitudes, or on providing individuals with information regarding the sustainable properties of different products (Heiskanen and Laakso, 2019). Such approaches are likely to be of limited use if pro-environmental attitudes are rarely translated to purchasing behaviour.

A number of studies have explored the attitude-behaviour gap. Gleim et al. (2013) propose a number of reasons as to why consumers may not buy in line with their stated attitudes and intentions. These will be explored in turn, as will their applicability to cleaning products.

2.2.1. Price

The simplest reason is the economic costs involved; green products are often priced significantly higher than conventional alternatives (Griskevicius et al., 2010; Lim, 2013; Peattie, 1995). Carrigan and de Pelsmacker (2009) state that on average, green products cost 45% more than their conventional counterparts in the UK market. Reasons for this were discussed in Section 2.1.3. Gleim et al. (2013) conducted a critical incident survey, asking consumers about the last time they had the opportunity to purchase a green product, and why they did not. 42.1% of individuals stated price as their primary inhibiting factor. Most consumers are only willing or able to act on their pro-environmental attitudes if it does not come at greater expense or sacrifice to them than selecting the conventional option (do Paço et al., 2013; Laroche et al., 2001). Hall (2011) argues that money is the fundamental feature of everyday sustainable consumption decisions, and the relationship between money and consumer ethics is complex and multifaceted.

Arguably, affordability is the central constraint to consumption choices (Hall, 2011). This is especially true in the context of the 2008 recession. Decreased consumer economic resources have amplified the effect of price, acting as a barrier to sustainable consumption (Connell, 2010; Carrigan and de Pelsmacker, 2009). Recovery from the recession has been slow and as a result, consumer confidence has been knocked. Thus, greater importance is placed upon value for money and more consumers than ever are switching from branded to own-brand products (Keynote, 2014). Even for consumers with strong environmental attitudes, price concerns will outweigh ethical considerations (Joshi and Rahman, 2015). Thus, price is always likely to be a facilitator of the attitude-behaviour gap.

Theoretically, simply decreasing the price of green cleaning products could narrow the attitude-behaviour gap and increase the consumption of sustainable alternatives. This is plausible; Kaufman (2014) suggests that consumers primary focus of green products is on financial incentives along with environmental protection claims. Ottman (2008) argues that to be successful, green products must offer a triad of reduced negative environmental impacts, reduced health and lifestyle impacts as well as improved economic benefits. Moraes et al. (2012) believe that in order to increase the demand for green products, these products need to be affordable and accessible. Until then, it is unlikely that mainstream consumers will adopt green alternatives (Ottman et al., 2006).

However, research suggests that providing a financial incentive for an otherwise ethically motivated behaviour may backfire. In the context of energy use, Schwartz et al. (2015) find that emphasizing the monetary benefit of the pro-environmental behaviour reduced participant willingness to undertake the behaviour. In addition, it also led to participants paying less attention to the environmental concerns associated with the behaviour, even if the environmental benefits were emphasized. Bolderdijk and Steg (2015) further this, stating that using financial over environmental benefits shifts the focus of the behaviour from pro-environmental to purely monetary. In the context of cleaning products, this could mean that consumers may purchase a green cleaning product if it were on promotion and reduced in price. Should the product then return to its full price, these consumers would be less likely to repurchase the product than individuals who chose the product purely for its environmental attributes. Additionally, it also emphasises the notion that pro-environmental behaviour is only worth engaging in if financial gain is to be made. Furthermore, other research avenues find that consumers may use the price of a product as a signal of its quality. With reference to organic products, high price indicates a higher quality and increases its desirability (Andersen, 2011; Rödiger and Hamm, 2015). The lower the price of an organic product, the worse it was expected to taste. To apply this to cleaning products, if a green cleaning product was priced lower than its conventional alternatives, consumers may perceive the product to be lower in quality. This in turn may reduce the likelihood of them purchasing this product.

As discussed, many would argue that the price of green products is the most important barrier to sustainable consumption. There is the general assumption that if prices were reduced below a certain threshold, more people would select green products over conventional alternatives. However, early research by Dickson and Sawyer (1990) would suggest that consumers are less aware of product pricing than one would assume. An observational study at point of product choice in a supermarket revealed that only 57.9% of consumers checked the price of the item they selected. Only 21.6% went on to check the price of an alternative brand, and 31.7% checked prices in order to make a brand choice. The study did not differentiate between green and conventional products. It would follow, however, that for price to be the main barrier of purchase for green products, a greater percentage of consumers would be comparing the prices of multiple products. This would be necessary in order to have an understanding of the average price of all products in the category, and to then be aware of the increased price of the green product.

Furthermore, more recent research provides persuasive evidence for a reduced role of price as a barrier for selecting organic food. In a government-subsidised study, the prices of a number of organic foods were reduced by up to 40% in Dutch supermarkets. Bunte et al. (2010) used sales data from 42 stores that took part in the study and 42 that did not over a period of 86 weeks. During this period, the price changes were clearly communicated and advertised to consumers. No significant differences were found between the test and control group price elasticities. This suggests that reduced price did not trigger growth for organic food. It is therefore possible that the greater cost of green products may not be as substantial a barrier for sustainable consumption as previously indicated.

Spending too much time focusing on whether reducing the price of green cleaning products would increase their popularity is arbitrary, as realistically this approach is unlikely to be implemented. The cost associated with producing green cleaning products is significantly greater than producing conventional cleaning products, due to more stringent production processes and supply chains (Keynote, 2015). Arseculeratne and Yazdanifard (2013) highlight the sources of higher costs for green companies: installation of new technologies, increased training costs, greater investment into research and development and the absorption of external costs. Peattie and Crane (2005) also note that production costs of green products are greater due to increased material costs and costs that can be associated with adhering to stricter regulations. Furthermore, large companies such as Unilever, Proctor and Gamble, Reckitt Benckiser and SC Johnson dominate the cleaning product market. While such companies may have the financial power to create green cleaning products at competitive prices, they focus on conventional cleaning product brands. Smaller companies produce green cleaning products; they do not have the resources to create ethical, sustainable products at prices that can compete with conventional alternatives (Keynote, 2014). It is therefore inevitable that the prices of green cleaning products will remain high. Thus, the price of green cleaning products will not be the primary focus of this research.

2.2.2. Lack of information, expertise and trust

A further barrier to sustainable consumption is the difficulties consumers face in accessing, understanding and trusting information relating to a products environmental impact (Gleim et al., 2013). This has implications for green promotion strategies as discussed in Section 2.1.3. For an individual to purchase the sustainable option, there is an assumption that they will be able to clearly categorize products as green or conventional, and then be able to evaluate each product against each other (Pancer et al., 2017). However, environmental qualities of a product are hidden information; a consumer cannot look at a product and clearly verify its environmental attributes. Here, consumers have to choose whether to trust or distrust the advertiser (Atkinson and Rosenthal, 2014).

Additionally, the environmental impact of a product is complex and multi-faceted; many different factors must be considered to get an accurate depiction. For example, one product may boast packaging made from recycled materials, whereas another may advertise its carbon neutral production processes. In such a scenario, it would be difficult for a consumer to be able to compare these products and identify the most sustainable option. It is thus the responsibility of manufacturers to provide environmental information to consumers in a way that they can easily understand (Rex and Baumann, 2007).

However, it appears that so far, manufacturers are failing at this. Greenpeace (2007) suggest that 64% of consumers find it difficult to identify an environmentally superior product. Market research by ASDA (2015) found that a third of consumers would purchase green cleaning products if they were provided with more information about their environmental benefits. The European Commission define green claims as: “the practice of suggesting or otherwise creating the impression…that a product or service is environmentally friendly…or is less damaging to the environment than competing goods or services” (European Commission et al., 2014, p. 8). Such green claims are often notoriously vague in their labelling, with many using words such as ‘green’, ‘eco-friendly’, ‘environmentally-friendly’, ‘natural’ and ‘non-toxic’, without explaining how or why the product can be described as such (Borin et al., 2011).

Furthermore, such terms are poorly understood, with unclear meanings and no widely accepted or understood definitions (Cervellon and Carey, 2011; Newell et al., 1998). Not only does this make identifying the most environmentally beneficial option difficult, it also raises scepticism surrounding green claims and distrust of the companies making them (Alevizou et al., 2015; Dahl, 2010; Wheeler et al., 2013). Additionally, it raises suspicions of greenwashing. Newell et al. (1998) define greenwashing as advertising in which the environmental claims are trivial, misleading or deceptive. Many advertisements including green claims are viewed as misleading, which reduces the credibility of the advertisement for the product and lowers purchase intentions (Newell et al., 1998). Consumers feel they cannot trust if a green product is actually green or if it is being claimed to be so in order for manufacturers to be able to cash in on a growing market. Similarly, consumers may believe that green marketing is simply an excuse to charge more for a product (Lim, 2013). Resultantly, the less credible or honest an environmental claim appears, the less likely consumers are to purchase a product or develop favourable opinions of it (Thøgersen, 2002).

It therefore follows that if greater effort was taken to inform consumers of a product’s environmental benefits, consumers may be more likely to purchase green products. Green information must be readily accessible, understandable and available at the point of purchase (Borin et al., 2011). Abbott (1997) supports this, indicating that consumers want more information, but in a simpler and easier to understand format than is currently available. The popularity of ecolabels has risen as a potential solution to this. Ecolabels are intended as a way of communicating the environmental quality of a product to consumers at the point of purchase (Thøgersen et al., 2010). They have the potential to provide a low effort way for consumers to differentiate between more or less sustainable product alternatives (Horne, 2009). Eco-labels are also seen as a way of boosting credibility to environmental claims, aiding with consumer trust and thus potentially decision-making (Thøgersen, 2002). Consumers are not confident in their own ability to judge environmental claims; eco-labels could remove lack of expertise as a barrier to sustainable consumption (Gleim et al., 2013).

Despite their promise, there is little consensus as to whether ecolabels result in green product choices. Some research does indicate that consumers do use ecolabels to guide their decision-making (D'Souza et al., 2006; Grankvist et al., 2004; Thøgersen, 2000). Xu et al (2012) indicate that green labels are important enablers for consumer willingness to pay a premium price for green products. However, there are a number of issues with relying solely on ecolabels to facilitate sustainable consumption.

For a consumer to use ecolabels as a decision-making tool, they must recognise the label, understand what it represents and trust the message it is conveying (Rex and Baumann, 2007). This is difficult for a number of reasons. Firstly, there are more than 463 different ecolabels worldwide to date across 199 countries and 25 industry sectors (Song et al., 2019). Ecolabels can be differentiated as to whether they are voluntary or mandatory, and whether they are awarded independently or self declared by manufacturers (Horne, 2009). It is unlikely that consumers will be able to identify which type of ecolabel is which. This vast range of different labels is likely to overload consumers and increase their confusion (Brécard, 2014; Moon et al., 2017).

Jackson and Snowdon (1999) suggest that the sheer amount of labels allow for multiple products to boast some form of environmental credential, making it difficult for consumers to decide between them. It would take great effort for consumers to research each label that they came across and evaluate it against the other alternatives; to do so would also require scientific literacy. In one study, 92% of consumers felt overloaded by information about eco-labels (Lloyd, 2006). Brécard (2014) indicates that consumers find it difficult to differentiate between the different labels and to distinguish which of them offer superior environmental performance. Consumer confusion as to which product is environmentally superior has now been replaced by confusion as to which eco-label is superior (Jackson and Snowdon, 1999).

Furthermore, with increasing amounts of self-declared eco-labels in the market place, the potential for greenwashing is still present (Czarnezki et al., 2014). Consumers are wary of the information provided by eco-labels, and are cynical about the manufacturing, labelling and certification processes behind a number of products (Joshi and Rahman, 2015; Nittala, 2014). Alevizou et al. (2015) find that self-declared environmental claims and labels increase frustration and suspicion within consumers, and that these feelings can spill over to externally certified labels. Rather than aiding consumer decision making, it is argued that ecolabels have the potential to impede it (Moon et al., 2017).

Even if ecolabel schemes operated perfectly as designed, it is still unlikely that this would result in a large-scale shift to environmentally preferable products. Ecolabels and other information provision strategies operate under the assumption that the majority of consumers hold pro-environmental attitudes, and will translate these attitudes to behaviours once they have the information necessary to make an informed choice between different products. This approach assumes that all individuals are equal in terms of how much they care about the environment or how much they believe in human impact on the environment. In reality, individuals differ widely on this variable. It also assumes that consumers will both notice and pay attention to eco-labels and environmental information. For low-involvement products, consumers take an average of five seconds to select a product (Thøgersen et al., 2012). Recent eye-tracking research finds that consumers pay little attention to ecolabels (Song et al., 2019). Furthermore, such strategies are aimed at changing the motivations and knowledge without consideration of the external context in which consumption decisions are made (Steg and Vlek, 2009). A number of contextual factors are likely to influence individual purchasing decisions: price (section 2.2.1), offers and promotion (Maniatis, 2016); availability, convenience, brand loyalty (Gleim et al., 2013), feelings of personal insignificance of actions (Lim, 2013) and contextual factors regarding the shopping environment itself (Broniarczyk and Griffin, 2014; see Section 2.4 for a detailed discussion of this).

2.2.3. Quality perceptions

A further explanation for the attitude-behaviour gap in the context of sustainable consumption is the perceived quality of green products. Quality was the second highest cited factor in Gleim et al. (2013)'s critical incident study. Gleim and Lawson (2014) find that over a third of consumers cite poor quality as a barrier to purchasing green products. Joshi and Rahman (2015) suggest that a product's functional attributes will always be valued over environmental attributes, even for consumers who display pro-environmental attitudes. Functional attributes provide greater consumer satisfaction than the environmental benefits of a product (Tseng and Hung, 2013). Luchs and Kumar (2017) find that consumers who select a product that offers greater sustainable benefits over functional performance experience distress due to their functional needs being compromised. There is a lay belief that for many products, the sustainable alternative is of lower functional quality than its conventional counterpart (Borin et al., 2011; D'Souza et al., 2007; Peattie, 2001).

Pickett-Baker and Ozaki (2008) highlight that for a green product to be successful, it must perform as effectively as conventional products. This is magnified by the fact that green products are largely made by smaller, lesser-known brands than market leaders (Keynote, 2014; Lim, 2013). The perceived risk of a product being of inferior quality is greater for lesser-known brands (Pickett-Baker and Ozaki, 2008). Cervellon and Carey (2014) suggest that when considering a green product, consumers will have strong beliefs regarding the quality of that product, even if they are unfamiliar with it. In the case of green products, this is often a negative quality perception. The stronger an initial belief is, the more resistant it is to change (Pomerantz et al., 1995). Carrington et al. (2014) identify that when committing to a green purchase decision, consumers sense a personal sacrifice to perceived product quality. Scepticism about product quality was a significant predictor of ambivalent attitudes towards green products; ambivalent attitudes in turn being a significant negative predictor of attitudes towards buying green products (Chang, 2011). When considered in the context of the premium price paid for green products, there is a lay belief that green products involve ‘spending more money for less’ (Peattie, 2001; D’Souza et al., 2007). Quality perceptions of green cleaning products will be discussed in more depth in section 2.5.

2.2.4. Critical examination of the attitude-behaviour gap

It is important to acknowledge the limitations and criticisms of research into the attitude-behaviour gap. Largely, these can be summarised through the implicit assumption that the attitude-behaviour gap is the result of the moral inadequacies of the consumer (Carrington et al., 2016). It is argued that the gap between stated attitudes and behaviours can also be the result of the researcher and their methodologies (McDonald et al., 2016; Auger and Devinney, 2007) and the contextual influence of structural elements and contemporary consumer capitalism (Carrington et al., 2016).

Positivist approaches have dominated the marketing literature, which has then in turn influenced research into sustainability and ethical consumption. McDonald et al. (2016) refer to the perception of the attitude-behaviour gap as a ‘black box’ in models of consumer behaviour; the resulting focus of the majority of research has therefore been on predicting and reducing this gap. However, it can be argued that the attitude-behaviour gap is the result of the approaches and methodologies employed by researchers (McDonald et al., 2016). Much of the research into the attitude-behaviour gap is quantitative in nature and relies heavily upon self-reported measures of attitudes, intentions and behaviours (Auger and Devinney, 2007). Such self-reported measures are not offered freely, but instead sought out by the researchers (McDonald et al., 2016). This is done largely via the use of surveys with questions neatly designed to explore different hypotheses, often measured via simple rating scales (Auger and Devinney, 2007). Research indicates that the way in which questions are phrased may have an influence on the resulting answers (Schwarz, 1999; 2003). This is especially true in the context of sustainable consumption research, whereby there is a strong social norm to act in a way that is responsible towards the environment. Additionally, there is no consequence for reporting mistruths. Thus, results from such surveys may overstate the influence of sustainability on consumer purchase decisions (Auger and Devinney, 2007).

Furthermore, the assumption that self-reported behaviour is a true reflection of actual behaviour is born out of the need to simplify the scenario in question and adapt it to exploration via surveys (McDonald et al., 2016). Self-reported future behavioural intentions and willingness to pay for a product are used unquestioningly as proxies for actual future behaviour and the actual price participants would pay for said products. Such questions fail to take into account the contextual complexities of consumption behaviour; indicating on a survey that one is highly likely to purchase a product in the future is different to actually purchasing it (McDonald et al., 2016).

On a broader level, Carrington et al. (2016) describe the attitude-behaviour gap as the result of the contradictions of contemporary capitalism. Sections 1.1.1 and 2.1.4 illustrate the debate resulting from attempting to address issues with consumption through consumption in a different form. Carrington et al. (2016) argue that the attitude-behaviour gap is the natural result of this paradox. They suggest that the attitude-behaviour gap “represents the difference between a capitalism that is flawed and destructive and one that creates a more just, sustainable and ethical world” (Carrington et al., 2016, p24). For as long as the attitude-behaviour gap is framed as an internalized issue besieging individual consumers, the responsibility to change the system – and world – through ethical consumption choices is placed firmly on individual consumers and not on the systemic and structural elements that shape consumer behaviour. Thus, the attitude-behaviour gap functions ideologically to sustain the neoliberal market rationalities that ethical consumerism hopes to change (Carrington et al., 2016).

It is not possible for the current research to address each of these limitations of the attitude-behaviour gap; research into the attitude-behaviour gap has been presented here in order to highlight the difficulties consumers may face when looking to consume in a more sustainable way. It is thus important to bare the limitations of such an approach in mind for the remainder of the research.

2.2.5. Summary

There is nothing to suggest that price, quality and lack of expertise, trust and understanding are mutually exclusive barriers to sustainable consumption. When asked about why they did not purchase a green product at their last opportunity to do so, the majority of individuals cited multiple reasons (Gleim and Lawson, 2014; Gleim et al., 2013). There is also nothing to suggest that a myriad of other reasons are not responsible for the attitude behaviour gap. It also follows that a combination of different approaches and methodologies is likely to be beneficial when considering sustainable consumption. However, to pursue such an avenue was beyond the scope of this research. Quality perceptions were chosen for further investigation for two main reasons. Firstly, quality perceptions provide greater potential for intervention than other factors such as price. Secondly, the area is currently under-researched in the context of green cleaning products. Section 2.5 provides a more detailed discussion of the quality perceptions of green cleaning products.

2.3. CLEANING PRODUCTS AND THEIR IMPLICATION FOR THE ENVIRONMENT AND HUMAN HEALTH

Cleaning is an act performed by individuals to improve the hygiene, aesthetic and scent of their home environment, as well as to reduce the spread of disease via disinfection (Goodyear et al., 2015; Nazaroff and Weschler, 2004; Terpstra, 2001). Disinfection refers to the eradication or inactivation of detrimental micro-organisms on surfaces or objects (Terpstra, 1998). Household cleaning products have been defined as “a product used for generalised and specialised cleaning in the home” (Keynote, 2014, p. 4). This research will focus on multipurpose surface cleaning products, defined as products used for cleaning and maintaining surfaces (Wolkoff et al., 1998). They are domestic necessities; almost every person will use some form of cleaning product on a daily basis (Keynote, 2014).

2.3.1. Ingredients in cleaning products

The average cleaning product will contain a mix of multiple different chemicals. Each chemical will have a different function within the product. Wolkoff et al. (1998) provide an excellent summary of this. Typically, cleaning products will consist of some form of active component(s), additives and water. Active components include the following: surfactants, solvents, water softeners (sometimes referred to as builders), pH regulators and disinfectants. Surfactants will loosen dirt, oils and grease from surfaces and prevent this material from adhering back to the surface by keeping them suspended in solution (Duthie, 1972; Richards et al., 2015; Scott and Jones, 2000). They are classified as anionic, cationic, non-ionic or amphoteric; non-ionic and anionic are the most common in multi-purpose cleaning products.

Acids and bases regulate the pH of the solution, as well as dissolving calcium and fatty acids respectively. Solvents are included in order to dissolve fatty materials, as well as keeping the solution homogenous. Water softeners dissolve and bind metal ions; these would reduce the action of the surfactant if allowed to remain present. Disinfectants are used to eradicate or inactivate unwanted microorganisms – these are often added if the product is advertised as antibacterial, or if it is intended for use in a particularly sterile environment. Additives may include corrosion inhibitors, fragrances and preservatives. Corrosion inhibitors are included if the product is intended for use on metal surfaces, as they protect these from corrosion. Fragrances add a pleasant smell to the product and mask any scent from the active components. Preservatives ensure the product remains free from microbial growth during the advertised lifespan for the product (Wolkoff et al., 1998). Table 1 provides a more detailed overview of the different functions of chemicals in cleaning products.

Table 1: Functions of cleaning product ingredients

Category	Description
Anionic surfactants	Used to change the surface tension of the water to assist cleansing, wetting surfaces, foaming and emulsifying. These are particularly effective at oily soil cleaning and oil/clay soil suspension. React in the wash water with the positively charged calcium and magnesium ions that can lead to partial deactivation.
Builder	Reduces the effect of water hardness by removing calcium and magnesium ions and increases the effectiveness of the detergent.
Bulking Agents	Added to increase the volume of a product through dilution, so that it can be applied at the correct concentration
Cationic surfactants	Used to change the surface tension of the water to assist cleansing, wetting surfaces, foaming and emulsifying. They also contribute to the disinfecting/sanitizing properties.
Chelating agents	Inactivates water hardness minerals calcium and magnesium and reduce effects of dissolved metals.
Colourants	Change the colour of the product.
Disinfectants	Inactivate infectious or undesirable bacteria, pathogenic fungi or viruses on surfaces.
Fragrances	Covers chemical odour of the base product and improves the scent of the product
Hydrotropes	Increase the solubility of the detergent in the product
Non-Ionic surfactants	Used to change the surface tension of the water to assist cleansing, wetting surfaces, foaming and emulsifying. They have no net electrical charge, making them resistant to water hardness deactivation. Grease removers.
pH regulators	Added to control the acidity/alkalinity of the products.

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	Acidic cleaners are efficient in removing limescale and rust stains. Alkaline cleaners remove fatty stains.
Preservatives	Protect products from microbial growth and spoilage. Required to prevent product damage caused by micro-organisms and to protect the product from accidental contamination by the consumer during use.
Solvents	Used to dissolve other ingredients
Viscosity regulators	Used to control the products ability to flow

2.3.2. Cleaning products and the environment

Recent changes to EU legislation have placed an increased importance on assessing the impact of widely used chemicals – such as those in cleaning products – on both the environment and human health (REACH (EC) 1907/2006; CLP-Regulation (EC) 1272/2008) (European Parliament and Council, 2008, 2006). As a result, more stringent testing of the biodegradation of such chemicals will be required, which may result in certain chemicals being phased out. Cleaning products are often disposed of down the drain, which may result in their release to sewage systems and potentially to aquatic ecosystems (Hinks et al., 2009; Richards et al., 2015). Multi-surface cleaning products are generally applied directly to the surface and wiped away with a sponge that is then rinsed, releasing the product to the water waste system. The sponge or cloth may then be disposed into the solid waste stream once the cleaning activity has been completed.

As a result of both this and their widespread use, traces of certain chemicals contained within cleaning products can be found in environmental surface waters, sediments and soils (Jardak et al., 2016; Ying, 2006). The use of cleaning products also contributes to indoor air pollution. This is exacerbated by the spray format that is employed by the majority of these products (Richards et al., 2015; Zock et al., 2007). Five overall impact categories of cleaning products have been identified: the impact of climate change on human health, fossil fuel depletion, the impact of climate change on ecosystems, natural land transformation and toxicity towards humans (Van Lieshout et al., 2015). Terpstra (2001) states that the use of cleaning agents has historically been associated with both the depletion of natural resources, along with the pollution of aquatic systems. However, it is also noted that reducing the use of cleaning agents without replacing them with suitable alternatives could endanger public hygiene (Terpstra, 1998). de Zwart et al. (2006) find that 3% of adverse health effects to fish were the result of chemicals that are disposed of down the drain. Surfactants are the main cleaning agent in multipurpose cleaning products; Cowan-Ellsberry et al. (2014) indicate that the widespread presence of surfactants was frequently found to be an important negative factor on ecological health. Large concentrations of surfactants are leached to the soil through the application of sewage sludge from wastewater treatment plants to agricultural land (Scott and Jones, 2000).

A small number of green cleaning products have thus been developed as an alternative for consumers concerned about the effect of these products on the environment. Green chemistry focuses on designing chemical products and processes that decrease or eradicate the use and production of hazardous substances. Green cleaning products are those that: satisfy the needs and desires of the consumer, are sustainable in terms of energy and resource consumption, are publicly acceptable and are safe (Peattie, 2001, 1995). Specifically, they tend to use biodegradable, non-toxic ingredients, minimise water usage throughout their life cycle and are packaged in material that is recyclable (Lin and Chang, 2012). The development of green cleaning products was the result of pressures from both industry and concerned consumers (Van Lieshout et al., 2015). Using Life Cycle Analysis (LCA) Kapur et al. (2012) demonstrate substantially lower environmental impacts for green cleaning products than conventional products. Richards et al. (2015) indicate that green cleaning products contain less total phosphorous than conventional products; phosphorous is detrimental to aquatic organisms. This suggests that green cleaning products do offer a reduced environmental impact than their conventional counterparts.

2.3.3. Cleaning products and human health

Cleaning products have also been found to have implications for human health. There are links between cleaning product usage and asthma, allergies and contact dermatitis (Le Moual et al., 2012; Magnano et al., 2009; Ramirez-Martinez et al., 2014; Zock et al., 2007). Asthma is a chronic disease of the respiratory system that causes bronchial hyper-reactivity, mucus overproduction, shortness of breath, wheezing and chest tightness (Lambrecht and Hammad, 2015). Cleaners have the highest rates of asthma of any occupational sector, and research suggests that cleaning products are one of the top exposure agents for this (Arif et al., 2008; Dumas et al., 2014; Le Moual et al., 2012; Ramirez-Martinez et al., 2014; Vizcaya et al., 2015; Zock et al., 2001). These can both exacerbate asthma symptoms in established sufferers, as well as triggering new onset occupational asthma (Siracusa et al., 2013). Vandenplas et al. (2013) demonstrate that a significant number of cleaners who experience asthma symptoms show a bronchial reaction pattern consistent with sensitizer induced occupational asthma. This suggests that it is chemicals within products used by the cleaners that have resulted in their asthma symptoms. Dumas et al. (2014) extend the link between cleaning products and asthma from occupational cleaners to individuals who clean in a domestic setting. This would suggest that a significant proportion of the population are at increased risk for severe respiratory illness due to the products they are using in their home.

In addition to asthma, allergic contact dermatitis is also prevalent among individuals frequently exposed to cleaning products. Allergic contact dermatitis is an inflammatory skin condition activated by contact with an environmental trigger (Nosbaum et al., 2009; Saint-Mezard et al., 2004). Symptoms of allergic contact dermatitis include: a painful rash, oozing and blistering, thickening and scaling of the skin, itchiness and swelling (Halloran, 2014). Allergic contact dermatitis may develop towards a previously safe substance (Kostner et al., 2017). Liskowsky et al. (2011) emphasise the increased risk of allergic contact dermatitis for occupational cleaners; between 10-21% are afflicted. Rastogi et al. (2001) note that fragrances in cleaning products are the most common cause of this skin disorder. 10% of individuals elicit an allergic reaction to at least one common fragrance ingredient (Heydorn et al., 2003; Rastogi et al., 2001). Fragrance allergies significantly impair quality of life in those who suffer (Heisterberg et al., 2014). Preservatives in cleaning products can also cause dermal issues; methylisothiazolinone is a common preservative known for its potential to induce allergic contact dermatitis (Johnston, 2014; Schnuch et al., 2011).

Some consumers look to green cleaning products as a potential way to minimise exposure to harmful ingredients. However, research into the health impacts of green cleaning products is limited to a few studies. One survey-based study reports that occupational cleaners who used green cleaning products were at a reduced risk for dermal, respiratory and musculoskeletal pain compared to those who use conventional cleaning products (Garza et al., 2015). Another study indicates that green cleaning products contain significantly fewer fragrance ingredients than conventional products, suggesting a reduced risk of allergic response to green cleaning products (Zarogianni et al., 2017). Other research finds no difference in the emission of toxic or hazardous volatile organic compounds between green and conventional fragranced consumer products (Steinemann, 2015). Thus, there is no clear consensus as to whether green cleaning products have fewer implications for human health than conventional cleaning products.

2.3.4. Gaps in the literature

The aim and approach of this project is mainly one from a consumer behaviour perspective; it is well beyond the scope of this research to conduct any extensive toxicological comparison between green and conventional cleaning products. However, consumer concern about chemicals in cleaning products is growing. Section 2.4 highlights how consumers may perceive green cleaning products as a potentially safer alternative to conventional cleaning products. For this perception to be further explored, it is important to address whether green cleaning products pose less of a risk to human health than conventional alternatives. If this is true, it could have important implications for the marketing of green cleaning products. Thus, an initial exploration into the differences between green and conventional cleaning products is of great importance.

2.4. THE DECISION MAKING CONTEXT AND HEURISTICS

2.4.1. The decision making context

When considering consumption, it is imperative to understand the context in which the consumption decision is being made, as well as the product that the decision is being made about (Carrington et al., 2010; Pickett-Baker and Ozaki, 2008). Rex and Baumann (2007) suggest that the context of consumption is more important than the profile of the consumer; individuals may make green purchasing decisions in one situation but not in another.

Cleaning products are largely purchased at supermarkets as part of a larger grocery shop (Keynote, 2014). The average supermarket contained around 40 000 items in 2000; it is likely that this number is even greater at the time of writing (Broniarczyk and Griffin, 2014; Iyengar and Lepper, 2000). Across the big five supermarkets, there are an average of 52 different multipurpose cleaning products available for consumers to choose from (ASDA, 2019; Morrisons, 2019; Ocado, 2019; Sainsburys, 2019; Tesco, 2019). A rationalist perspective of consumer behaviour would suggest that purchasing decisions are the result of conscious calculations to identify the product that delivers the most utility to the consumer (Pachauri, 2002). Maximising product choice involves selecting the best possible option by exhaustively evaluating and comparing each of the available alternatives (Cheek and Ward, 2019). It could be argued that such a vast range of products to choose from empowers consumers, allowing for greater freedom of choice and increasing the likelihood that the ideal product for the consumer is available for purchase.

However, greater product choice can also increase the difficulty in decision making for consumers via three constructs: task complexity, trade-off difficulty and preference uncertainty (Broniarczyk and Griffin, 2014). The greater the number of choices in the choice set, the more complex and time consuming the decision making task becomes. Contradictory product information – for example, two different products each asserting that they are the best at a cleaning task – makes it difficult for consumers to identify the best product to fulfil their needs (West and Broniarczyk, 1998). Marketers often seek to differentiate their products from other available options and may do so through unique product descriptions or highlighting attributes specific to their product. If all of the available products in the choice set do not have information relating to this attribute, it becomes increasingly difficult for the consumer to be able to compare each product and identify the option they perceive to be best for them (Broniarczyk and Griffin, 2014).

Trade-off difficulty refers to the phenomena by which consumers will have to sacrifice one goal for another. In a purchasing situation, a consumer may have multiple motivations. For example, a consumer may wish to purchase a product that will clean their surface to a desired standard, smells pleasant, leaves no residue and eliminates bacteria. There may be one product in the choice set that advertises a scent particularly attractive to a consumer, but makes no reference to bacteria eliminating properties. A different product may have no scent information available to the consumer at the point of purchase, but claim to eliminate a high percentage of bacteria. Here, the consumer must consider which of the goals are of most importance to them, and then consider the potential consequences of trading off one goal for another (Broniarczyk and Griffin, 2014). To apply this to sustainable consumption decisions, a consumer's willingness and intention to be environmentally responsible is unlikely to be the only determining factor (Davis, 2013; Rokka and Uusitalo, 2008). Furthermore, consumers will not have perfect information about each of the products qualities, instead having to infer these using prior experiences, product packaging and their own perceptions of the product (Luchs et al., 2010). This increases the cognitive load of the decision making process (Einhorn and Hogarth, 1981).

Preference uncertainty refers to the idea that for certain products, consumers may not have a clear preference. This can exacerbate the difficulty of decision-making. Consumers thus have to create preferences at the point of purchase, and then evaluate each product in reference to these newly generated preferences. For many products, the differences between them will be minimal, and not evident until the point of consumption. This amplifies the preference uncertainty, resulting in greater decision-making difficulty (Dhar, 1997). Evidence thus suggests that while consumers may be attracted to the greater amount of choice, it tends to result in worse decision-making outcomes, greater choice dissatisfaction and fewer purchases (Broniarczyk and Griffin, 2014).

2.4.2. Heuristics

Cleaning products address a purely functional need for consumers; they are purchased to fulfil the need for a clean home (Bodur et al., 2015; Habib et al., 2006; Terpstra, 1998). Thus, attributes of primary importance when considering cleaning products are utilitarian in nature, relating to product functionality and efficiency (Cervellon and Carey, 2014; Dhar and Wertenbroch, 2000). They are a necessity, repeat purchase item with a perceived low risk; purchasing an unsatisfactory cleaning product is less likely to cause distress to the consumer than purchasing an unsatisfactory computer or car (Deshpandé and Hoyer, 1983; Thøgersen et al., 2012). Early research suggests that when a product is relatively unimportant and purchased frequently, consumers are unlikely to apply a great deal of thought to their decision-making (Hoyer, 1984; Krugman, 1965).

Jacoby (1984, 1977) emphasises the limited capacity for information of consumers; they do not undertake extensive, rational evaluations of each product's attributes. The cognitive effort required to enable consumers to select the best possible product for their needs becomes a trade-off in itself with the time required to do so. Consumers protect themselves from vast quantities of information by disregarding all but a subset of it (Bettman, 1979). With over 40 000 items in a supermarket and numerous purchase decisions to be made, it is unrealistic to expect consumers to methodically evaluate every possible alternative for each product category they require. Rather than utilising all possible available information, consumers centre their purchase decision on the most important product attributes (Jacoby et al., 1977). When observed in a supermarket, consumers took only 13 seconds from entering the aisle to selecting a laundry product, with 72% of consumers selecting the first product they picked up (Hoyer, 1984; Leong, 1993). It is thus evident that for low risk, repetitive purchase decisions, consumers are unlikely to undertake an extensive evaluation of every possible option. Instead, consumers are content to satisfice as opposed to maximise product choice.

Satisficing involves selecting a product that is simply 'good enough' as opposed to the best possible option (Schwartz et al., 2002; Stüttgen et al., 2012). Satisficing allows the consumer to select a product with minimal cognitive effort, optimising time and effort as opposed to choice consequences (Einhorn and Hogarth, 1981; Hoyer, 1984). In order to satisfice, consumers use crude heuristics in order to judge product efficacy and guide purchase decisions (Leong, 1993). Heuristics are cognitive simplification processes that aid in reducing the difficulty of the decision making process (Schwenk, 1984). Öhman (2011) argues that the consumption decision process relies on habituation, heuristics and rules of thumb. Despite best consumer intentions, purchasing decisions are usually based on habitual and unconscious processes as opposed to fully informed choices (Roberts and Nedungadi, 1995).

Research suggests a number of heuristics may come into play, including: selecting the best known brand, selecting the lowest priced item or selecting the item from this product category that has been previously purchased (Thøgersen et al., 2012). Initial choices are likely to be almost random, but will then be guided by post-purchase evaluation of the consumption decision (Hoyer, 1984). If the initial product performed satisfactorily, then the consumer may continue to purchase this product repeatedly. This repeat purchase acts as a simple way to reduce the decision-making effort; the consumer knows this product will meet their needs and therefore they do not need to consider other options. If the product is unsatisfactory, the consumer will select a different product at the next opportunity to purchase. These evaluations enhance consumer knowledge; the act of selecting a low involvement product becomes entirely automatic and habitual, reducing the need for any in-store search or conscious control (Leong, 1993; Pachauri, 2002).

A further heuristic of importance to the current research is that of familiarity; preference for a neutral stimulus increases the more that one is exposed to it (Zajonc, 1968). Novel stimuli are connected with uncertainty, whereas familiar stimuli are perceived to be safe (Zajonc, 1980, 1998). From a consumer behaviour perspective, this may suggest that the more familiar a consumer is with a product or product category, the more favourably they will perceive it. Additionally, the consumer will also perceive the product as posing less of a risk (Song and Schwarz, 2009). Furthermore, when individuals believe that they have adequate information about the risks related to a particular issue, further information seeking activities pertaining to the risks posed by this issue are limited. This concept is known as information sufficiency (Griffin et al., 1989). Individuals experienced with specific products or product categories believe they have achieved information sufficiency and therefore refrain from any further information search (Eiser et al., 2002; Fischer and De Vries, 2008). Thus, when a consumer develops familiarity with products, future purchase decisions surrounding these products are likely to be driven by prior attitudes, feelings and emotions that have been driven from accumulated experience rather than new information (Fischer et al., 2005). This has been supported by research into food preferences; the repeated positive consumption experience of a familiar food stimulates the development of a strong positive heuristic for future decisions regarding this food (Fischer and De Vries, 2008). When foods are familiar, previous attitudes and experiences contribute towards product risk and benefit perceptions (Fischer and Frewer, 2009). Thus, consumers perceive the familiar product to be less risky and have greater benefits than an unfamiliar product. This is likely to drive consumer preference towards the familiar product.

2.5. GREEN AS A HEURISTIC

Evidently, consumers use heuristics to guide their purchase decisions, especially for low involvement, repeat purchase products. It is therefore important to consider the role of heuristics for green products, and what a product's environmental status may signal to consumers. A seminal theory within this domain is that of the sustainability liability (Luchs et al., 2010;

section 2.5.1.1). While so far this theory has only been empirically tested for product quality, the current research will attempt to extend this framework in the domain of product safety perceptions by exploring links between perceived product quality and perceived product safety. The empirical basis for this will be discussed in the following sections.

2.5.1. Environmental attributes and perceived product quality

As touched upon in section 2.2.3, it is clear that the environmental attributes of a product have implications for perceived quality. Early research would suggest that the environmental benefits of a product should always increase overall product appeal. Nisbett and Wilson (1977) propose the halo affect: the idea that one beneficial attribute of a product will lead to more favourable evaluations of the products other attributes. If a consumer values sustainability, and a product is advertised as sustainable, this should lead the consumer to value the product favourably not only on its environmental credentials but on all other salient product attributes. Furthermore, the majority of individuals would categorize the attribute of ‘environmentally-friendly’ as a positive quality and it would thus invoke some form of positive emotion. The affect heuristic would therefore suggest that as a result of this positive emotion, a product with environmental attributes would thus be perceived favourably (Slovic et al., 2007). This research would suggest that a product’s environmental attributes would aid in forming a positive opinion of the product and thus encourage its purchase.

Nonetheless, evidence for such a unidirectional relationship is limited. While stated consumer demand for green cleaning products is high (Keynote, 2014), the market share for these products does not reflect this (Luchs et al., 2010; Porges, 2007). Brands focused on providing green household cleaning products fail to compete with market leaders and report substantial losses at year-end (Keynote, 2014). However, this is not true for all green products. Between 2013-14, specialist brands focused on providing green health and beauty products grew by 20%; a growth outpacing that of the wider health and beauty market (Keynote, 2016). Cervellon and Carey (2014) note that green beauty products are viewed as purer and more effective than conventional alternatives. This suggests a more complex relationship between a product's environmental attributes and its popularity with consumers.

2.5.1.1. Theoretical framework: The sustainability liability

As opposed to a basic linear relationship whereby a product's environmental status increases its appeal to consumers, it instead appears that consumers favour green products in certain product categories but disfavour them for others. The following research explores this phenomenon by suggesting that consumers may use the products environmental attributes as a heuristic in itself, and that this may signal different things to consumers based on what category the product belongs to. Whether a product's environmental status is viewed as beneficial or detrimental to product performance is governed by the consumer's requirements of the product. This is known as the sustainability liability (Luchs et al., 2010).

Luchs et al. (2010) state that a product's environmental attributes may be perceived as a strength or weakness, depending largely on which category the product in question belongs to. At the point of purchase, consumers have to make quick inferences about valued product attributes, but do not possess all of the necessary information to make fully informed judgements (Magnier and Schoormans, 2015). Thus, consumers must use available information – e.g. packaging, ingredients, prior experiences etc. (Luchs et al., 2010) – to guide their decision-making. Consumers then use these inferences as provisional hypotheses with the potential to prejudice judgements about a product's missing attributes. For one attribute to dominate within a product, individuals believe that this must lead to some form of disadvantage for other, less visible attributes (Shiv et al., 2005). While many consumers hold pro-environmental attitudes (Carrington et al., 2010) and may value environmental attributes in isolation, a products environmental status may also affect perceptions of the products other attributes. For a product to achieve superiority on one attribute – environmental performance – the product may be perceived to be inferior on other attributes, such as product performance and strength (D'Souza et al., 2007; Esty and Winston, 2006; Lim, 2013). For different product categories, different attributes will be valued.

Gildea (2001) state that socially conscious companies are viewed by consumers as safe, gentle and protective. An emphasis on ethicality indicates trustworthiness, sincerity and generosity, but is less of a display of effectiveness, competency and efficiency (Aaker et al., 2010). Luchs et al. (2010) extend these associations from companies to products. Implicit Association Tests confirmed that individuals associate greater product ethicality with gentleness, and lower product ethicality with strength. Consumers assume that the two qualities are mutually exclusive – a product can be green, or it can be strong, but it can not be both (Bodur et al., 2015). It then follows that if gentleness is a valued product attribute – for example, in baby shampoo or personal care products – then a products environmental status will be seen as beneficial to the overall product, and the green product will be preferred.

However, for products where strength is valued, a green product is likely to be perceived as weaker and less effective than its conventional counterpart. In this instance, the conventional product is likely to be preferred. Gleim and Lawson (2014) indicate that functional, repeat purchase items such as cleaning products are the most common category whereby green products are initially sought but overlooked for conventional products. Cleaning products are a widely cited example of a product whereby strength should be valued (Bodur et al., 2015; Lin and Chang, 2012; Luchs et al., 2010). The primary purpose of a cleaning product is to clean the home and to eradicate harmful bacteria or viruses (Terpstra, 2001). It thus follows that strength would be an important quality in a cleaning product.

There is a small yet growing body of research into the sustainability liability, and such studies require more detailed attention. Using online surveys, Luchs et al. (2010) demonstrate the sustainability liability across a range of different hypothetical products: car shampoo, baby shampoo, car tyres, laundry detergent and hand sanitizer. Gentleness is valued in baby shampoo, and strength in car shampoo. The sustainable brand of baby shampoo was preferred over the conventional brand, with the opposite being proven for car shampoo. Prior to the survey, pre-tests confirmed the valued attributes for both products.

In a separate study, the authors furthered their initial research by exploring the sustainability liability with supposedly real rather than hypothetical products (Luchs et al., 2010). Participants were presented with two t-shirts; one of which they were informed was washed in a sustainable brand of detergent, the other with a conventional brand. In reality, both t-shirts were washed in a third, unscented brand of detergent. Therefore, this study did not actually explore perceptions of real products. Results indicated that participants believed that the average American consumer would prefer the less sustainable brand of detergent. This demonstrates the sustainability liability in the domain of cleaning products, albeit a different category than the current research.

Finally, the sustainability liability was then explored in an observational study using hand sanitizer (Luchs et al., 2010). Two bottles of hand sanitizer were set up in a business school cafeteria; neither of the brands actually made claims regarding their sustainability. One was clear in colour, the other green. The green one was labelled as eco-friendly, the clear one was labelled as regular. A confederate recorded individual choice of hand sanitizer. When individuals were aware that their choice was being recorded, 78% chose the green hand sanitizer. When individuals were not aware that their choice was being recorded, this dropped to 27%. This was replicated by Mai et al. (2019). Taken together, the results from the above studies provide sophisticated evidence for the sustainability liability as well as its applicability outside of a laboratory environment.

Further research has built on the initial work by Luchs et al. (2010). Lin and Chang (2012) provide further evidence for the sustainability liability. They extend it to suggest that inferences about a green products functional performance can also influence how much of that product is used postpurchase. The authors replicated the hand sanitizer study initially conducted by Luchs et al. (2010), with two main differences. Firstly, the same brand of hand sanitizer was used as both the conventional and the green product. To signal that the hand sanitizer was green, a label denoting the environmental qualities of the product was attached to the hand sanitizer. Secondly, the products were not offered simultaneously and instead each product was offered singularly on alternating days. Here, choice of hand sanitizer was not the dependent variable, but instead how much of each brand of hand sanitizer was used. A significantly greater amount of the green hand sanitizer was used than the conventional hand sanitizer. This was hypothesised to be the result of negative quality perceptions; individuals perceived the green sanitizer to be weaker than the conventional hand sanitizer, and thus used more of it to achieve the desired effect.

Lin and Chang (2012) go on to demonstrate that the effects of the sustainability liability on product usage are more pronounced for consumers who are high in environmental consciousness. This is demonstrated using mouthwash as the focal product. Participants were randomly assigned to evaluate either a green or conventional brand of mouthwash – in reality, the product was identical across both conditions. Participants were asked to demonstrate how they would use the product before rating it in terms of effectiveness and future purchase intentions. Finally, participants completed the New Environmental Paradigm - a measure of environmental consciousness (Dunlap et al., 2000; Dunlap and Van Liere, 1978).

The authors reported a “marginally significant” main effect of product type on the amount of product used, although the p value of 0.06 here means that this main effect could be disputed (Lin and Chang, 2012, p129). According to the authors, participants used significantly more of the mouthwash when it was framed as green compared to when it was framed as a conventional product. Furthermore, it was found that this effect was stronger for consumers high in environmental consciousness; i.e. those with strong positive beliefs about the environment. Perceptions of product effectiveness were found to mediate this relationship, thus suggesting that green consumers (those who scored highly on the NEP) were likely to have more experience with green products and thus be aware of the potential differences in product strength. As such, they would believe the products to be less effective and therefore use more of the mouthwash. This result was replicated in a separate study using glass cleaner as the product of interest.

Further evidence for the sustainability liability is provided by Zhu et al. (2012). Zhu et al. (2012) demonstrate that a hypothetical cleaning product named 'BalanceClean' was judged as more effective than the same product named 'BalanceGreen'. Perceived product efficacy judgements also influenced how much of a product is used; participants using 'BalanceGreen' used 20% more of the product than those who used 'BalanceClean'. This replicates the results of Lin and Chang (2012) by finding that individuals tend to use more of a green product in order to counteract the perceived inferior quality of the green product.

Taken together, the above research suggests that individuals may use a product's environmental status as a heuristic for inferring product strength. This is evident both at the product selection and consumption stage. Thus, the sustainability liability has implications for the purchase and use of green cleaning products. Beliefs about the product's strength – or perceived lack of – may act as a barrier towards purchasing green cleaning products, as well as dictating how much of the product is required for satisfactory performance.

2.5.2. Environmental attributes and perceived product health and safety

The environmental attributes of a product can also have implications for perceived product safety. As discussed in section 2.3, cleaning products consist of a number of chemicals that allow the product to fulfil its intended purpose. There is little consensus as to whether green cleaning products are less harmful to human health than conventional alternatives. In recent years, consumers are growing increasingly concerned about chemicals in products. While a green cleaning product may be perceived to be less effective in quality, it may also be perceived as less harmful to health than conventional products. Consumers associate environmental qualities with being protective, gentle, friendly and safe (Gildea, 2001; Luchs et al., 2010); they also perceive green products to be less strong than their conventional counterparts. As a side effect of the sustainability liability, it is possible that consumers may perceive green products as less harmful to human health due to perceptions of inferior strength. This is yet to be empirically tested explicitly in the context of the sustainability liability, but evidence to suggest a relationship between environmental qualities and product safety will be discussed.

Consumers are positively inclined towards the concept of ‘natural’. Natural objects are frequently viewed as inherently healthier than non-natural objects (Rozin, 2005). Naturally sourced substances are believed to be safer than those of synthetic origin (Bearth et al., 2017; Goodyear et al., 2015; Rozin et al., 2012). A study on cigarette smoking demonstrates how pervasive this belief is. A brand of cigarettes advertised as ‘natural’ and ‘additive-free’ were judged by 40.3% of participants to pose less of a risk to health than other brands of cigarettes. This remained true even in the presence of a label clearly stating that these cigarettes posed an identical health risk (Leas et al., 2016; O’Connor et al., 2017). Similarly, consumers retain a preference for natural labelled food products in spite of evidence that natural and synthetically produced products are identical (Rozin et al., 2012).

Research into organic food indicates a positive linear relationship between environmental friendliness and health, showing that consumers intuitively link the two concepts (Lazzarini et al., 2016). This is once more demonstrated in cosmetics and personal care products, with consumers perceiving green products to be more beneficial to their health and posing less of a risk than conventional alternatives (Kim and Seock, 2009; Liobikienė and Bernatonienė, 2017). Furthermore, environmental consciousness and health consciousness were shown to be positively correlated, suggesting a close perceived relationship between environmental and human health (Kim and Seock, 2009). As green cleaning products are advertised as ‘non-toxic’, ‘natural’, ‘organic’ or ‘plant-based’, it is credible that consumers may believe green cleaning products to be a healthier, safer alternative to other brands.

Bearth et al. (2017) demonstrate this within the category of cleaning products. When asked to rate different cleaning products in terms of the danger they pose to health, participants rated green cleaning products as much safer than experts did. Individuals assumed that the ‘strong’ cleaning products must contain more hazardous and toxic ingredients (Bearth et al., 2017). As the green cleaning products scored lowly in terms of perceived risk to health, it is reasonable to infer that participants believed them to be less strong than conventional cleaning products. This potentially hints at a relationship between the environmental status of a product, its perceived quality and perceived risk to human health. It is therefore possible that as well as using a product’s environmental attributes as a heuristic for perceived product quality, consumers may also use them as a heuristic for perceived product safety.

2.5.3. Gaps in the literature

Previous research provides a convincing theoretical base for the existence of the sustainability liability; for product categories where strength is valued, individuals do appear to perceive green products as less effective than their conventional counterparts. However, there are a number of limitations to this research that restrict the applicability of the sustainability liability to real life purchase and consumption scenarios.

The first and most obvious of these is that none of the current research into the sustainability liability has attempted to explore differences in quality perceptions between existing green and conventional products. Luchs et al. (2010) do somewhat attempt this; in the laundry detergent study they do use existing brands of detergent. However, in reality the t-shirts were actually washed in a third brand of detergent. Thus, the product performance comparison was not actually conducted using existing brands of products. The current research aims to address this by using existing products widely available for purchase. Similarly, as the majority of research into the sustainability liability has focused on hypothetical brands, this means that the researcher has manipulated differences between strength and environmental attributes. Distinctions between green and conventional products may not be as clear-cut in reality as they are when experimentally manipulated. This provides further justification for the inclusion of existing products into the current research.

Secondly, the initial research by Luchs et al. (2010) largely involved online surveys, whereby participants did not physically interact with any of the products they were evaluating. Whilst the research carried out by Lin and Chang (2012) did involve participant and product interaction, again the products were identical across conditions and from hypothetical brands. Thus, further research is required to explore the sustainability liability with real products that participants physically interact with. Little research into the sustainability liability has attempted to address actual product choice. Instead, future purchase intentions are largely used as a proxy for actual purchase behaviour. The above limitations have important implications for the applicability of the research to real life consumption decisions.

Bearth et al. (2017) showed that consumers perceive green cleaning products to be less hazardous to human health than conventional cleaning products. When asked to rate different cleaning products in terms of the danger they pose to health, participants rated green cleaning products as far safer than experts did. Individuals assumed that strong cleaning products must contain much more hazardous, toxic ingredients. This is supported by the research of Luchs et al. (2010), who would suggest that green products are perceived to be weaker and less effective than conventional alternatives. This suggests a link between consumer associations of green products, perceived product efficacy and health. However, to the author's knowledge, no study has directly assessed consumer perceptions of both the perceived efficacy and perceived health benefits of green cleaning products. Furthermore, if consumers may infer perceived product safety from a product's environmental status, this may also guide their perceptions of the ingredients and chemicals contained within the products. No such research has yet addressed whether consumers perceive less of a risk from the chemicals contained in green cleaning products than those in conventional cleaning products. The current research aims to address this.

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3: Comparing the environmental and health impacts of green and conventional household cleaning products

3.1. INTRODUCTION

We have seen in the previous chapter how the ingredients in cleaning products may have implications for environmental and human health (Sections 2.3.2 and 2.3.3 respectively). Cleaning products consist of a complex formula of different chemicals, each with different functions within the product. The nature of each chemical within the cleaning product will influence the impact it may have on human health. Preservatives, solvents, surfactants and disinfectants are potential groups of ingredients of concern in industrial cleaning products due to their associated skin and respiratory problems (Bello et al., 2009; Ramirez-Martinez et al., 2014). There is also growing concern about the inclusion of fragrance ingredients in cleaning products (Magnano et al., 2009; Nazaroff and Weschler, 2004; Steinemann, 2016, 2009). Fragrances do not add anything to the product's ability to clean, but instead are included to appeal to consumer senses and thus help to increase sales (Milotic, 2003; Zarogianni et al., 2017). Many popular fragrance ingredients are linked to allergic skin reactions in individuals (Magnano et al., 2009; Siracusa et al., 2013). Certain fragrance ingredients can react in the indoor atmosphere to produce secondary pollutants, and many of these are known to be irritating to the skin or respiratory system (Nazaroff and Weschler, 2004; Solal et al., 2008; Steinemann, 2009).

However, there are a number of different fragrance, preservative, solvent or surfactant ingredients contained within cleaning products, some of which will be more harmful than others. Previous research has largely focused on identifying individual chemicals in cleaning products that may be harmful to the user; there is a distinct lack of research taking into account the complex mixture of chemicals within cleaning products and their associated effects (Gerster et al., 2014). It is thus important to examine the formulation of widely available cleaning products in order to understand which products contain the greatest amount of harmful ingredients and thus pose the greatest concern.

There has been an increase in the number of green cleaning products that are available to the everyday consumer (Ottman et al., 2006). While in the past these products may only have been available in specific health food stores, they have recently penetrated the mainstream market. As such, a small number of green cleaning products are now available in UK supermarkets (Key Note, 2014). Such products include phrases such as ‘non-toxic’, ‘natural’ and ‘plant-based’ within their marketing, which may lead consumers to view green cleaning products as a healthier, safer alternative (Crighton et al., 2013; Garza et al., 2015; Klaschka, 2016; Yeomans et al., 2010). Consumers are more inclined to purchase green products due to perceived benefits to health than to the environment (Glegg and Richards, 2007; Ottman et al., 2006).

Despite this, research on the health effects of green cleaning products is limited to a few studies. One survey based study reports that cleaning staff who used green cleaning products were at a reduced risk for dermal, respiratory and musculoskeletal pain compared to those who used conventional cleaning products (Garza et al., 2015). Using a qualitative chemical analysis, Zarogianni et al (2017) compared the amount of fragrances in conventional and green cleaning products and found that the majority of fragrances could be found in conventional cleaning products. As fragrances have previously been found to have adverse health effects (Magnano et al., 2009; Nazaroff and Weschler, 2004; Steinemann, 2016, 2009), this could suggest a benefit of green cleaning products for human health. However, this study only includes a small range of products across a number of different cleaning product categories. Other research suggests that there is no difference in the emission of toxic or hazardous volatile organic compounds between green and conventional fragranced consumer products (Steinemann, 2015). Thus, further research is warranted.

Changes to legislation have led to greater information becoming publicly available regarding the contents of cleaning products. This is discussed in greater depth in Section 1.1.3. To briefly summarise, chemicals in consumer products are now to be registered with a central agency (ECHA) along with the hazards they may pose to environmental and human health. Chemicals are classified into different hazard categories, and these hazard categories determine the hazard statement and pictogram that is associated with each chemical. If a product contains a chemical at a certain concentration it must display the appropriate pictogram and hazard statement on its packaging. Additionally, if a product contains one of 26 known fragrance allergens in a concentration equal to or greater than 0.01%, this must be declared in the product ingredient list. Producers of cleaning products are also required to provide a full ingredient list for each product on a corresponding website and the address of this must be present on product packaging. Thus, some information is available to consumers who may have an interest in further understanding what is contained in cleaning products, although it is unclear how many consumers actually access this information or how useful they find it. While the information is there, it is difficult for an everyday consumer to access and understand. Furthermore, relevant information is spread across multiple sources; synthesising the information contained in each of them is difficult and time-consuming for the everyday consumer. The current research links these different sources of information and uses them to provide an exploration into differences between green and conventional cleaning products, in as much detail as this publicly available information allows.

3.1.1. Research hypotheses

A general aim of the current study is to provide an exploratory look into the composition of currently available multi-purpose surface cleaning products within the UK market and their potential hazards to human health and the environment, based on information publicly available to consumers. As this is the first piece of research of its kind and there is contradictory evidence for health benefits of green products, the hypotheses are two-tailed. In particular, the research hypothesises:

1. That there will be differences in the associated environmental and human health hazards between conventional and green cleaning products.
2. That there will be differences in the associated environmental and human health hazards between the different functions of ingredients contained within cleaning products.

3. That there will be differences between the number of different functional ingredients contained in green and conventional cleaning products.
4. That there will be ingredients contained in both types of products that may pose a particular concern.

3.2. METHOD

3.2.1. Product selection

To identify cleaning products available to UK consumers, websites of the following supermarket retailers were consulted: ASDA, Morrisons, Ocado, Sainsburys and Tesco. These retailers were selected as they are the largest supermarkets within the UK; these are the places where the majority of consumers will purchase their cleaning products. Thus, the products stocked there are products that the everyday consumer will either have used or be familiar with. For the purpose of this research, only multi-surface cleaning products were selected, and other types of cleaning products such as washing up liquid and laundry detergent were excluded. Multi-surface cleaning products occupy a significant portion of the overall cleaning product market, and are the most frequently used type of cleaning product (Key Note, 2014). Multi-surface cleaning products largely come in spray format, which facilitates respiratory exposure to a greater extent than powdered or liquid products (Zock et al., 2007). Thus, multi-surface cleaning products were selected as the starting point for this research. Own brand products were also excluded due to difficulties in accessing ingredient information. Thus, every available branded multi-purpose cleaning product from each of the supermarkets during the search period (February-June 2016) was recorded, yielding a list of 97 multipurpose surface cleaning products.

3.2.2. Composition information

Composition information for each of the cleaning products was identified using manufacturer websites and recorded into a database. Figures 1 and 2 show an example of the ingredient information that is available on the product itself (Figure 1) and on the product's corresponding website (Figure 2). Not all manufacturers published detailed enough composition information to allow for analysis, thus excluding a further 2 products. One of the green products included in this research did not have a full ingredients list online, however the ingredients could be deduced from the products Safety Data Sheet (SDS). It is important to note that information regarding the concentration of every ingredient within the product is not publicly available for any product. The concentration of an ingredient will have an impact on the degree of hazard it poses to the environment and to human health. As this information was not available, the concentration could not be taken into account. Instead, simply the presence of an ingredient with the associated environmental or human health hazards was recorded. Should concentration information ever become publicly available, a more detailed analysis could be conducted.

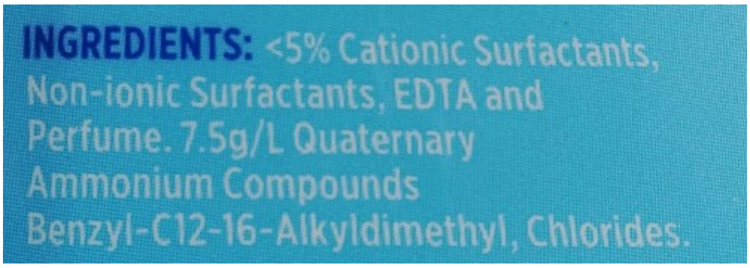

Figure 1: Example of ingredient information on product packaging (authors own photograph)

Ingredients

Aqua
Propylene Glycol Propyl Ether
Sodium Lauryl Sulfate
Sodium Phosphate
Sodium Ethylhexyl Sulfate
Citric Acid
Monosodium Citrate
Phosphoric Acid
Parfum
Xanthan Gum
Limonene
Benzisothiazolinone

Figure 2: Example of ingredient information from product website (Unilever, 2017)

The final database consisted of 95 products and 174 different chemicals. Of these products, 16 were marketed as green and 79 were regarded as conventional on the basis that they made no specific reference to environmental credentials. The functions of each of the chemicals within the database were then identified using information from manufacturer websites, the Human and Environmental Risk Assessment on ingredients of household cleaning products (HERA) website, the American Cleaning Institute website and the Cleanright website. These are the only such organisations to provide lists of the chemicals commonly contained within cleaning products and their functions. Whilst one of these information sources is American and the research is focused on UK products, each chemical has its own universally recognised identification number (CAS number). It was therefore possible to ensure that the same chemical was being referred to across all sources. Where possible, each chemical was cross-referenced between websites in order to ensure the information was accurate. Refer to Table 2 for a list of the different functions of ingredients and a description of their role within cleaning products.

Table 2. Ingredient functions within multi-surface cleaning products

Category	*Description*
Anionic surfactants	Used to change the surface tension of the water to assist cleansing, wetting surfaces, foaming and emulsifying. These are particularly effective at oily soil cleaning and oil/clay soil suspension. React in the wash water with the positively charged calcium and magnesium ions that can lead to partial deactivation.
Builder	Reduces the effect of water hardness by removing calcium and magnesium ions and increases the effectiveness of the detergent.
Bulking Agents	Added to increase the volume of a product through dilution, so that it can be applied at the correct concentration
Cationic surfactants	Used to change the surface tension of the water to assist cleansing, wetting surfaces, foaming and emulsifying. They also contribute to the disinfecting/sanitizing properties.
Chelating agents	Inactivates water hardness minerals calcium and magnesium and reduce effects of dissolved metals.
Colourants	Change the colour of the product.
Disinfectants	Inactivate infectious or undesirable bacteria, pathogenic fungi or viruses on surfaces.
Fragrances	Covers chemical odour of the base product and improves the scent of the product
Hydrotropes	Increase the solubility of the detergent in the product
Non-Ionic surfactants	Used to change the surface tension of the water to assist cleansing, wetting surfaces, foaming and emulsifying. They have no net electrical charge, making them resistant to water hardness deactivation. Grease removers.
pH regulators	Added to control the acidity/alkalinity of the products. Acidic cleaners are efficient in removing limescale and rust stains. Alkaline cleaners remove fatty stains.
Preservatives	Protect products from microbial growth and

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	spoilage. Required to prevent product damage caused by micro-organisms and to protect the product from accidental contamination by the consumer during use.
Solvents	Used to dissolve other ingredients
Viscosity regulators	Controls the products' ability to flow

Information from the HERA and AISE websites, accessed 30/4/16.

3.2.3. Environmental and human health information

The European Chemicals Agency (ECHA) website was then used to identify all environmental and human health hazards associated with each of the chemicals. In total there were 4 different environmental hazards and 16 human health hazards that were associated with at least one of the chemicals within the database; Tables 3 and 4 provide an overview of these.

Table 3. Environmental hazards

Name of hazard	***Description***
Very toxic to aquatic life	Injurious to fish/crustaceans/aquatic plants upon short-term exposure to the substance
Very toxic to aquatic life with long lasting effects	Causes long term adverse effects to aquatic organisms upon exposure to a low concentration of the substance
Toxic to aquatic life with long lasting effects	Causes long term adverse effects to aquatic organisms upon exposure to a medium concentration of the substance
Harmful to aquatic life with long lasting effects	Causes long term adverse effects to aquatic organisms upon exposure to a high concentration of the substance

Information from the European Chemicals Agency guidance document on the application of the CLP Regulation (European Chemicals Agency, 2015)

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Table 4. Human health hazards

Name of hazard	*Description*
Causes severe skin burns	The production of irreversible damage to the skin typified by ulcers, bleeding, bloody scabs, discolouration, areas of alopecia and scars
Causes skin irritation	The production of reversible damage to the skin
May cause allergic skin reaction	A substance that will lead to an allergic response following skin contact
Harmful in contact with skin	Produces adverse effects following dermal exposure to concentrations of the substance between 1000 – 2000 mg/kg body weight.
Toxic in contact with skin	Produces adverse effects following dermal exposure to concentrations of the substance between 200-1000 mg/kg body weight.
Fatal in contact with skin	Produces adverse effects following dermal exposure to concentrations of the substance between 50-200 mg/kg body weight.
Respiratory irritation	Adverse effects to the respiratory system for a short duration following exposure.
May cause allergy or asthma symptoms or breathing difficulties if inhaled	A substance that will lead to hypersensitivity of the airways following inhalation of the substance
Harmful if inhaled	Produces adverse effects following inhalation exposure to concentrations of the substance between 1.0-5.0 mg/l.
Toxic if inhaled	Produces adverse effects following inhalation exposure to concentrations of the substance between 0.5-1.0 mg/l.
Fatal if inhaled	Produces adverse effects following inhalation exposure to concentrations of the substance of 0.05mg/l or lower.
Causes drowsiness or dizziness	Adverse effects to the neurological system for a short duration following exposure

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Causes damage to organs	Specific, non-lethal target organ toxicity arising from single or repeated exposure to a substance or mixture.
May cause genetic defects	Substances known or suspected to induce heritable mutations in the germ cells of humans.
May cause cancer	Known, presumed or suspected human carcinogens.
May damage fertility or the unborn child	Causes or is suspected of causing adverse effects on sexual function and fertility in adult males or females, as well as developmental toxicity in the offspring

Information from the European Chemicals Agency guidance document on the application of the CLP Regulation (European Chemicals Agency, 2015)

Five other human health hazards were noted, but excluded from analysis as they were deemed as being the result of the misuse of the product as opposed to simple exposure. These were: harmful if swallowed, toxic if swallowed, severe eye damage, eye irritation and serious eye irritation. All of the above information was correct at time of submission, but is subject to change.

3.3. RESULTS

3.3.1. Differences in environmental and human health hazards between green and conventional products

The data were analysed using IBM SPSS Statistics 22 to look for any significant differences in associated environmental and human health hazards between green and conventional products. In this analysis, the independent variable was whether the product was considered green or conventional. The dependent variable was the amount of chemicals per product with each associated hazard. For example, a product may contain 4 chemicals that cause skin irritation, 2 that are toxic to aquatic life etc. Due to non-normality of the data, a Mann-Whitney U test was conducted. Mann-Whitney U tests are regarded as a non-parametric version of an independent t-test and are used to compare differences between two samples of different sizes (Field, 2013). The data is ranked by the test; ranks are assigned in ascending order to the values of the dependent variable regardless of which group of the independent variable they are in and the analysis is conducted on the ranked data. The differences between the mean ranks of the group are then compared; if there are significant differences, the mean rank of one group will be higher than the other. Significance levels are reported at the two-tailed level, as no prior predictions were made.

- Green products contained significantly fewer chemicals that could cause severe skin burns than conventional products, U = 436.5, z= -2.056, p=<.05.
- Green products contained significantly fewer chemicals that could be harmful in contact with skin, U = 475.5, z = -2.020, p=<.05.
- Green products contained a significantly greater number chemicals that could result in damage to organs than conventional products, U = 420.00, z = -2.614, p=<.01.
- Green products contained a significantly greater number of chemicals that could be toxic in contact with skin than conventional products, U = 304.5, z = 2.195, p=<.001.
- Green products contained a significantly greater number of chemicals that could be fatal in contact with skin than conventional products, U = 479.5, z = -2.184, p=0.05.

A Bonferroni correction was then applied to account for multiple tests[4]. The only difference to remain significant at the corrected p value of 0.0026 was that between green and conventional products on toxic in contact with skin. No significant differences between green and conventional products were found for any of the environmental effects, nor for human health effects of interest such as skin irritation, allergic skin reactions or respiratory irritation/allergic reaction. This is shown in Table 5.

[4]It is important to acknowledge the conservative nature of the Bonferroni correction; using the resulting corrected p value is likely to increase the chances of making a Type II error (Field, 2009). It is thus possible that some of the previous results are in fact statistically significant. However, the bold nature of any claims made from these results and the implications they could have for the green cleaning product industry as well as the fact that important concentration information was missing meant that as much statistical certainty in the results as possible was paramount and as such, a Bonferonni correction was deemed suitable.

Table 5: Differences in environmental and human health hazards between green and conventional products

Hazard	Green or conventional	N	Mean rank	Median	Mann Whitney U
Very toxic to aquatic life	Conventional	79	47.3	2.0	576.5
	Green	16	48.57	2.0	
Very toxic to aquatic life with long lasting effects	Conventional	79	48.22	1.0	535.5
	Green	16	43.7	1.0	
Harmful to aquatic life with long lasting effects	Conventional	79	46.39	1.0	505.5
	Green	16	53.33	1.0	
Toxic to aquatic life with long lasting effects	Conventional	79	47.47	0	590.5
	Green	16	47.63	0	
Severe skin burns	Conventional	79	49.33	1.0	426.5
	Green	16	36.43	1.0	
Harmful in contact with skin	Conventional	79	49.33	0	448.0
	Green	16	37.87	0	
Harmful if inhaled	Conventional	79	49.31	0	449.5
	Green	16	37.97	0	
Skin Irritation	Conventional	79	46.45	4.0	509.5
	Green	16	53.03	4.0	
Respiratory Irritation	Conventional	79	47.08	1.0	559.5
	Green	16	49.70	1.0	
Allergic skin reaction	Conventional	79	47.14	2.0	564.5
	Green	16	49.40	2.0	

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Allergic respiratory reaction	Conventional	79	47.98	0	554.5
	Green	16	44.97	0	
Suspected reprotoxic	Conventional	79	47.78	0	570.0
	Green	16	46.0	0	
Damage to organs	Conventional	79	45.17	0	408.5*
	Green	16	59.77	1.0	
Toxic if inhaled	Conventional	79	45.59	0	442.0
	Green	16	57.53	1.0	
Toxic in contact with skin	Conventional	79	43.8	0	300.0***
	Green	16	67.00	1.0	
Fatal in contact with skin	Conventional	79	46.07	0	479.5*
	Green	16	55.03	0	
Fatal if inhaled	Conventional	79	46.16	0	487.0
	Green	16	55.03	0	
Suspected of causing genetic defects	Conventional	79	47.50	0	592.5
	Green	16	47.50	0	
Suspected carcinogen	Conventional	79	47.78	0	570.0
	Green	16	46.00	0	
Drowsiness or dizziness	Conventional	79	46.53	0	516.0
	Green	16	52.6	0	

**Significant at p=<0.05*

***Significant at p=<.01*

****Significant with Bonferroni adjusted p value of 0.0026*

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3.3.2. Differences in environmental and human health hazards between the functions of chemicals contained within the cleaning products

Following the previous analyses, the data were analysed to see if there were any specific functions of ingredients more likely to be associated with environmental or human health hazards. The total number of chemicals of each function was calculated per product. For example, a product may have 2 non-ionic surfactants, 4 fragrance ingredients, 2 preservatives etc. The total number of chemicals with each hazard classification was calculated per product. For example, a product may contain 3 chemicals that are toxic to aquatic life, 4 that may cause skin irritation, 3 that may cause respiratory irritation etc. The analysis thus compared whether the number of chemicals of a particular ingredient function per product was associated with the number of chemicals per product that could result in each hazard classification. Due to non-normality of the data and multiple levels of the independent variable, a Spearman's Rho correlational analysis was selected. The results from these are shown in Tables 6 and 7.

Table 6: The association between functions of chemicals and environmental hazards

	Non-Ionic surfactant	Builder	Cleaning Agent	Colourant	Chelating Agent	Fragrance	Preservative	Solvent	Anionic Surfactant	pH adjuster	Viscosity modifier
Very toxic to aquatic life	.171	.084	-.193	.109	-.016	.629**	.181	-.069	-.218*	-.029	-.168
Very toxic to aquatic life with long lasting effects	.171	.084	-.193	-109	-.016	.629**	.181	-.069	-.218*	-.029	-.168
Harmful to aquatic life with long lasting effects	.156	.298**	.166	.006	.274**	.442**	.221*	.101	.331**	.202*	-.173
Toxic to aquatic life with long lasting effects	.339**	.216*	-.174	.027	.290**	.447**	.474**	.127	.178	.131	.001

**Significant at 0.01 level (2-tailed)
* Significant at 0.05 level (2-tailed)

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Table 7: The association between function of chemical and hazards to human health

	Non-Ionic Surfactant	Builder	Cleaning Agent	Colourant	Chelating Agent	Fragrance	Preservative	Solvent	Anionic Surfactant	pH Adjuster	Viscosity Modifier
Severe skin burns	-.020	.229*	.438**	-.170	.138	-.279**	-.015	.178	.210*	.123	-.097
Harmful in contact with skin	.037	-.148	-.245*	.002	-.176	-.326**	-.374**	.105	-.269**	-.001	-.070
Harmful if inhaled	.204*	.127	-.274**	.091	.073	-.022	-.054	.107	-.015	.331**	-.090
Skin Irritation	.191	.225*	.073	.014	.335**	.632**	.573**	.188	.403**	.263*	.282**
Respiratory Irritation	-.077	.040	.293**	-.190	-.019	.074	.218*	.075	.310**	.254*	.252*
Allergic Skin Reaction	.258*	.162	-.217*	.190	.311**	.847**	.677**	.154	.156	.011	.007
Allergic Respiratory Reaction	-.201	-.247*	-.257*	.213*	-.144	.016	.080	.068	.-.008	.049	-.038
Suspected Reprotoxic	-.220*	-.111	-.193	-.043	-.122	.178	.045	.068	-.092	.082	.119
Damage to organs	-.117	-.195	-.074	-.003	-.002	-.241*	.067	.032	-.187	.330**	-.006
Toxic if inhaled	-.048	-.319**	-.239*	-.097	-.174	-.100	-.024	.319**	-.261*	.011	-.011
Toxic in contact with skin	.014	-.185	-.118	.075	-.093	-.129	.011	.301**	-.096	.037	-.091
Fatal in contact with skin	-.150	-.267**	-.049	.092	.001	.074	.385**	.094	-.068	.272**	-.066
Fatal if inhaled	-.150	-.282**	-.010	.077	-.031	.063	.416**	.079	-.097	.245*	.021
Suspected carcinogenic	-.032	.013	.062	.140	-.080	-.055	.145	-.121	.146	.066	.255*
Drowsiness and dizziness	.045	-.189	.041	.008	.018	-.153	.061	.263*	.135	.025	.045

**Significant at the 0.01 level (2-tailed)
* Significant at the 0.05 level (2-tailed)

While the pattern of results was different for each hazard, preservatives and fragrances were identified as being most reliably associated with hazards to the environment and human health, with fragrances in particular a cause for concern.

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3.3.3. Differences in the functions of chemicals contained in cleaning products between green and conventional products

The data were then analysed to assess whether green products contained a lower number of preservatives or fragrances than conventional products. For this analysis the independent variable was whether the product was green or conventional. The dependent variable was the number of chemicals of each function per product. For example, a product may contain 3 fragrances, 2 preservatives, 2 solvents etc. A Mann-Whitney U test (section 3.3.1.) was conducted due to non-normality of the data. After a Bonferroni correction, a corrected p value of 0.0041 was used. Green products were found to contain significantly fewer anionic surfactants ($U=357.00.0$, $z = -2.978$, $p=.003$). No significant differences were found between the amount of preservatives or fragrances contained within green and conventional products. This suggests that green and conventional multipurpose surface cleaning products contain a similar number of fragrances and preservatives.

3.3.4. Chemicals of concern

Following the analysis, the complete list of chemicals was consulted to identify the most commonly occurring ingredients and their associated environmental and human health hazards. Ingredients contained in more than 10% of products were identified; any ingredient with at least one environmental hazard and one human health hazard were selected for further attention (Table 8). The exception to this was linalool; despite having no associated environmental hazards, the high prevalence of it within products and its sensitizing properties allowed for its inclusion.

Table 8. Chemicals of concern

Name	*Function*	*Percentage of products contained in*	*Environmental hazards*	*Human health hazards*
Benzisothiazolinone	Preservative	43.6	Very toxic to aquatic life	Skin irritation, allergic skin reaction
Limonene	Fragrance	40.4	Very toxic to aquatic life, very toxic to aquatic life with long lasting effects	Skin irritation, allergic skin reaction
Linalool	Fragrance	36.1	N/A	Skin irritation, allergic skin reaction
Hexyl cinnamal	Fragrance	32.9	Very toxic to aquatic life, very toxic to aquatic life with long-lasting effects	Allergic skin reaction
Benzalkonium Chloride	Cationic surfactant	19.1	Very toxic to aquatic life, very toxic to aquatic life with long-lasting effects	Harmful in contact with skin, harmful if inhaled
Ethanolamine	Solvent	14.9	Harmful to aquatic life with long-lasting effects	Severe skin burns, harmful in contact with skin, harmful if inhaled, toxic if inhaled, may cause damage to fertility or the unborn child, respiratory irritation, allergic skin reaction, allergic respiratory reaction
Butylphenyl Methylpropional	Fragrance	14.9	Toxic to aquatic life with long lasting	Suspected reprotoxin, skin

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			effects	irritation, allergic skin reaction
Methylisothiazolinone	Preservative	10.6%	Very toxic to aquatic life, very toxic to aquatic life with long-lasting effects	Fatal in contact with skin, fatal if inhaled, severe skin burns, may cause damage to organs, allergic skin reaction, respiratory irritation

The percentage of products within each category (green or conventional) containing each of these chemicals was then compared. This is displayed in Figure 3. A higher percentage of green products contained limonene, linalool, methylisothiazolinone and butylphenyl methylpropional than conventional products. A higher percentage of conventional products contained ethanolamine, hexyl cinnamic aldehyde and benzalkonium chloride.

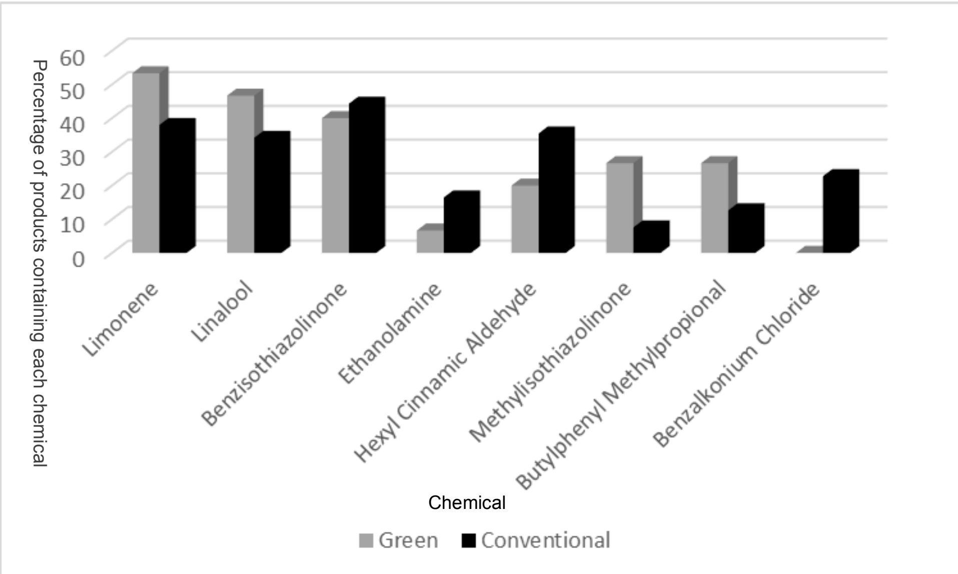

Figure 3: Percentage of products in each category that contain chemicals of concern

3.4. DISCUSSION

3.4.1. The hypotheses

There were no significant differences between green and conventional products and the number of chemicals contained that posed environmental hazards. Green cleaning products were also found to contain a significantly greater number of different chemicals that could be toxic in contact with skin.

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There were no significant differences between green and conventional products and the number of chemicals that could result in an allergic skin or respiratory reaction, or respiratory and/or skin irritation. Hypothesis 1 was therefore unsupported. This suggests limited benefits of green cleaning products on health in comparison to conventional cleaning products. Preservatives and fragrances were found to be significantly associated with an allergic skin reaction, thus supporting Hypothesis 2. No other significant differences were found between the function of the ingredient and their associated human health or environmental hazards. The only significant differences found between green and conventional products and ingredient functions were between chelating agents and anionic surfactants. No significant differences were found between green and conventional cleaning products and the amount of preservatives or fragrances contained; Hypothesis 3 is therefore unsupported. Ingredients of potential concern were found in both green and conventional cleaning products, providing support for Hypothesis 4. This further supports the notion that green multipurpose surface cleaning products have limited benefits for health in comparison to conventional cleaning products.

3.4.2. Green vs conventional products

No significant differences were found between the number of detrimental environmental hazards per product for green and conventional products. Considering that the marketing of green cleaning products is based solely around their increased environmental credentials, this is somewhat surprising. It would be expected that green cleaning products would contain fewer chemicals with environmental hazards (as classified by ECHA) than cleaning products that make no claims as to their environmental credentials. Additionally, no significant differences were found between green and conventional products in their likelihood to cause respiratory irritation, an allergic skin reaction or an allergic respiratory reaction.

Green multipurpose surface cleaning products also did not differ from conventional cleaning products in the number of preservatives or fragrances that they contained; two ingredient functions found to be linked with allergic skin reactions. Many consumers who experience allergies to chemicals contained in cleaning products look to green cleaning products as a safer alternative (Glegg and Richards, 2007). One brand of green cleaning products were specifically advertised as hypoallergenic and allergy friendly; these products were found to contain a number of fragrance and preservative ingredients that are associated with an allergic skin reaction. This finding is supported by the wider literature; personal care products advertised as suitable for sensitive skin were found to contain strong or medium contact allergens (Klaschka, 2010). For these ingredients to be listed on the product label they must be present in concentrations equal to or greater than 1%; for some of these ingredients this concentration may be great enough to provoke an allergic reaction (Basketter et al., 2015; Buckley, 2007; Lundov et al., 2011).

The present research thus suggests that this lay belief held by consumers that green cleaning products are more beneficial to health than conventional cleaning products may be unfounded (Garza et al., 2015; Glegg and Richards, 2007; Yeomans et al., 2010). For some green cleaning products, the marketing of them as a 'non-toxic' alternative to conventional cleaning products could be considered misleading. Many of them boast naturally sourced ingredients as an environmental benefit; consumers associate natural with 'safer' (Garza et al., 2015). However, it is the properties and not the origin of the chemicals contained within these products that determine their effects on the environment and human health (Klaschka, 2016).

From this, it seems that individuals wishing to purchase products safest to their immediate health and environment would be better off consulting the ingredients list rather than simply selecting green products. In line with CLP Regulation (EC) 1272/2008, there is a published list of 26 known fragrance allergens that must be disclosed on product packaging. Consumers with fragrance allergies would be best to familiarise themselves with this list and avoid products accordingly, rather than relying on a product being marketed as green as an indicator of its suitability for their needs.

However, in practice, it is not this simple. There are debates as to whether the list of 26 fragrance allergens includes all of the known fragrance allergens (Klaschka, 2010). Furthermore, declaring the ingredient presence on a label is only required if the product contains the ingredient in a concentration of or higher than 1%. Thus, a consumer – and indeed, this analysis - may be led to believe a product does not contain the ingredient they are sensitive to if it is not declared in the ingredients list, when in reality the product may contain the ingredient just under the threshold concentration for labelling. An analysis of cleaning products found that many fragrances contained in the product are not disclosed on the label (Zarogianni et al, 2017). There is also discussion regarding the validity of the threshold levels themselves (Klaschka, 2010). Research also suggests that many consumers with fragrance allergies find reading the ingredients labels extremely difficult; especially those with lower education levels (Noiesen et al., 2007). Thus, further work is required to make avoiding products containing allergens easier for those who suffer.

3.4.3. Ingredient functions

In line with previous research, preservatives and fragrances were found to be significantly associated with the risk of an allergic skin reaction (Bello et al., 2009; Magnano et al., 2009; Ramirez-Martinez et al., 2014; Steinemann, 2009). Allergic skin reactions are of particular interest because they are one of the main, more serious hazards associated with the ingredients of cleaning products that may be provoked even at a low concentration (Pesonen et al., 2014). A chemical may be classified as fatal in contact with skin, for example, but in reality it is highly unlikely that an individual will die if they were to come into contact with a cleaning product containing that chemical. This is due to the low concentration of the chemical within the product. However, allergic reactions to an ingredient within a product can be triggered upon exposure to a low concentration of that ingredient; acceptable exposure levels of known sensitizers are frequently contested (Basketter et al., 2015).

Benzisothiazolinone and methylisothiazolinone were the two most common preservatives; isothiazolinones are known skin sensitizers (Schnuch et al., 2011). While allergies to benzisothiazolinone are relatively uncommon, afflicting 0.2% of the population, the incidence rate of contact allergy to methylisothiazolinone is as high as 8.3% and predicted to increase (Johnston, 2014; Lundov et al., 2013; Schnuch et al., 2011). Due to its sensitizing properties, the maximum permitted concentration of methylisothiazolinone in household products is 100ppm and at this concentration its presence and potential for an allergic response must be declared on product packaging (Lundov et al., 2010). However, individuals with allergies to methylisothiazolinone have exhibited reactions at concentrations as low as 10ppm (Lundov et al., 2011). Methylisothiazolinone is also a common preservative in a number of other consumer goods such as cosmetics, paints and glues (García-Gavín et al., 2010; Thyssen et al., 2006). It is thus possible that individuals may be exposed to multiple sources of methylisothiazolinone great enough to elicit an allergic response.

Fragrances are the most common cause of allergic contact dermatitis, with around 10% of individuals eliciting an allergic reaction to at least one common fragrance ingredient (Heydorn et al., 2003; Rastogi et al., 2001). Fragrance allergies have been shown to significantly impair quality of life in those who suffer, and thus warrant further attention (Heisterberg et al., 2014). In line with previous research, the two most common fragrance ingredients were limonene and linalool, present in 40.4 and 36.1% of products respectively (Christensson et al., 2016; Rastogi et al., 2001). Limonene and linalool react with the air to produce oxidation products; these are more potent sensitizers than limonene and linalool themselves (Audrain et al., 2014; Pesonen et al., 2014). While only 0.2% of individuals elicit allergic reactions to limonene and linalool, 5.2% - 6.9% of individuals display a contact allergy to oxidised limonene and oxidised linalool respectively (Audrain et al., 2014; Bråred-Christensson et al., 2016). As oxidised limonene and oxidised linalool are not routinely included while testing for fragrance allergies, many individuals may display an allergic response without being aware of the source of their allergen (Audrain et al., 2014). Fragrance concentrations in cleaning products can range from 1-3%, and many different fragrance ingredients will be contained within one product to achieve the desired scent (Basketter et al., 2015). Thus, the maximum concentration of an individual fragrance ingredient within a product is likely to be 0.3%; those with an allergy to oxidised linalool may display a reaction upon exposure to concentrations of 0.3% (Basketter et al., 2015; Christensson et al., 2016). In a sample of occupational cleaners, an oxidised limonene allergy was observed in those who used surface cleaning products that contained limonene. This suggests that limonene was contained in high enough concentrations within these products to elicit an allergic response (Pesonen et al., 2014). The high prevalence of these ingredients within cleaning products and relatively low concentrations at which they can provoke an allergic response thus pose a cause for concern.

3.4.4. Ingredient information provision

An important consideration highlighted by the present research is the need to determine exactly how beneficial the current format of ingredient information provision is to consumers. To find out what is contained within a single cleaning product, what these ingredients do and their associated environmental and human health hazards required consulting a number of different information sources, not all of which the everyday consumer would be aware of. While there has been a greater emphasis on transparency to consumers, it is unlikely that the majority of individuals would expend the time and energy required to source this information. Firstly, the product packaging had to be examined to find the initial ingredients list and link to the corresponding website. Following this, the product website was accessed to identify the most detailed ingredient list. Then each ingredient had to be searched for on the ECHA website; some chemicals would yield no results, or there would be multiple entries for chemicals of the same name. Additional research then had to be conducted to identify which of these entries were correct. To identify the functions of each chemical in the product, further websites had to be visited and understood, all of which requiring somewhat advanced scientific knowledge.

An everyday consumer is unlikely to go to such lengths; research suggests that at most consumers will read the first few sentences on the back of a product, or simply the directions for use (Riley et al., 2001). Even if a consumer was to attempt to access all of this information to make an informed choice, they must have the correct knowledge and scientific understanding to be able to process and utilise this information (Klaschka, 2010). Long chemical names are off-putting for even the most interested of consumers, let alone the additional work required in order to understand what the chemical does and its potential for harm (Noiesen et al., 2007). Further research is required to assess how successfully consumers access and understand this information, and whether the current method for conveying this information is enough for consumers to make a fully informed choice.

3.4.5. Limitations

While considering these results, it is important to take into consideration a number of limitations of the current research. Firstly, while the composition of each product could be identified, the concentrations of the chemicals within each product are not publically available and thus not taken into account. Concentration information is largely considered proprietary; very limited information about the concentration of certain components is included on the products safety data sheets and thus available to the public (Bello et al., 2009; Faludi et al., 2016; Gerster et al., 2014). The concentration of an ingredient within the product is correlated with its impact; the higher the concentration the higher the likelihood of a detrimental impact (Van Lieshout et al., 2015).

In this research, the number of different chemicals with each hazard within each product was used as the dependent variable for the majority of the analyses. This would assume that each of these chemicals are present in the same concentration, and thus a product containing a greater number of hazardous chemicals is therefore more detrimental to the environment and/or human health than one that contains a lesser number. However, a product may contain multiple hazardous chemicals but at concentrations too low to be of harm (Corea et al., 2006). The risk posed by a chemical is the function of its associated hazards and the level at which individuals will be exposed to it; a product may contain a hazardous chemical but at such a low concentration that exposure is minimal (Lee et al., 2013).

Previous research does suggest that the concentration of ingredients within cleaning products is generally below acceptable exposure levels for their associated hazards (Basketter et al., 2015). However, these acceptable exposure levels are based on a single exposure to the chemical in question, and do not take into account multiple exposure sources or the combination of chemicals contained within a product. Limited research exists both on the effects of aggregate exposure sources to the same chemical, and for the synergistic effects of exposure to multiple chemicals at once (Zarogianni et al., 2017)). Until this research exists - and until manufacturers release concentration data - the results of this study should be interpreted cautiously.

Aquatic and human toxicity is not the only impact associated with cleaning products; there are a number of other areas in which products can have environmental impacts. Thus, just because a green cleaning product's composition may not significantly differ in terms of toxicity from conventional products does not mean that the green cleaning products are as detrimental to the environment as conventional products. While the product formulation plays an important role in a product's impacts, other aspects such as the production and source of chemicals, the product packaging and consumer usage all contribute to a products environmental impacts (Kapur et al., 2012; Koehler and Wildbolz, 2009; Van Lieshout et al., 2015). Previous research has suggested that while the impacts from the formulation of the product may be higher for green cleaning products, their overall environmental impacts were significantly lower than conventional counterparts (Kapur et al., 2012).

Many green brands boast plant based and naturally sourced ingredients; while these may have the same toxicity profile to their synthetically produced counterparts, the production impacts are generally lower (Jessop et al., 2015; Klaschka, 2016). Some green brands are focusing heavily on investing in the production of biosurfactants; these are viewed as a promising, more sustainable alternative to synthetic surfactants (Jessop et al., 2015). The current research could only take into account quantifiable information available to consumers. Thus, it was beyond the scope of the current research to take into account these other impacts, and it is instead recommended that they be considered in future research.

An additional limitation is that by grouping products into categories of green and conventional, any within-category variance between products is lost. The results of this analysis are particularly unfavourable towards green cleaning products and would suggest that there are no real environmental or health benefits of green cleaning products over conventional ones. However, while this may be true for green cleaning products as an overall category, it is highly likely that some green cleaning products will offer a reduced environmental and human health impact. This may also be true for conventional cleaning products: some will perform better on environmental and human health criteria than others. As there appear to be no meaningful differences between categories, it therefore becomes even more important to make comparisons between individual products regardless of their environmental credentials.

Attempts were made to address this; multi-criteria decision-making (MCDM) methods such as the weighted sum method (WSM) were considered and attempted for further analysis. MCDMs are used in order to identify the best alternative when multiple criteria require consideration (Deepa et al., 2019). Such methods require the identification of criteria – in this case, the environmental and human health hazards – and the application of weights to these criteria. Weights are a numerical representation of the importance of each criterion. An overall score for each option (in this case, product) is calculated taking into account the score on each criterion and it’s associated weighting. Each option is then ranked in accordance with these scores (Deepa et al., 2019).

The weight of each criterion is therefore highly influential in the overall ranking; changes to each weighting can significantly influence the resulting order (Ma et al., 1999). The weighting process is largely subjective and relies upon experts to assign appropriate weights to each criterion. In this research, there were multiple different environmental and human health hazards that do not lend easy to comparison. While ECHA indicate a clear hierarchy for harmful, toxic, very toxic and fatal, assessing the relative importance of each of the different human health hazards is difficult. For example, allergic reactions are deeply unpleasant for those with allergies, but completely harmless in those without. Would that make an allergic skin reaction more detrimental than a chemical which is harmful in contact with skin – a less severe response, but one which is likely to affect more people? A chemical fatal in contact with skin is one of the most severe hazards, but unlikely to result in death in the concentration contained in cleaning products. Therefore, should ‘fatal in contact with skin’ have a greater weighting than other less harmful but more likely hazards? Multiple iterations of the WSM were conducted in order to try and identify the most and least harmful products, with different assigned weightings. The rank of the products changed

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drastically with changes in the weighting of hazards, and it was thus not felt to be robust enough to be relied upon as the sole method of analysis. Future research should attempt to address a method of weighting the environmental and human health hazards to allow for MCDM methodology to be successfully and reliably employed.

3.4.6. Conclusions

No significant differences were found between green and conventional cleaning products regarding their likelihood of hazard to human health and the environment. In terms of toxicity, clearly all cleaning products will pose some degree of risk. This research has combined green and conventional cleaning products into categories and as such the results may seem particularly pessimistic. On an individual level there will be some green cleaning products that are better for the environment or for human health than conventional cleaning products. However, this research has proven that for consumers wishing to select a product that is less harmful to both the environment and human health, relying on a product being green is not enough. Those wishing to choose a cleaning product with minimal risk to the environment or to human health will need to pay close attention not only to the ingredients list but also to the overall sustainability efforts of the company that produce it. For now, a product labelling itself as green is not enough to guarantee that it will be the most beneficial choice for both the user and the environment. Further work is required to understand the best method to convey important information to consumers in a way that allows them to make a fully informed choice.

4: Experimental consumer comparison of green and conventional household surface cleaning products

4.1. INTRODUCTION

The increasing number of sustainable product options available to consumers combined with increased incidence of pro-environmental attitudes would suggest that when faced with a choice between a green product and its conventional alternative, the green product should always be favoured. Nevertheless, the attitude-behaviour gap is well documented (Carrington et al., 2014; Gleim et al., 2013), and market shares for green products indicate a lack of popularity with consumers (Keynote, 2014). However, this is only true for certain product categories of green products. Between 2013-2014, sales of green health and beauty products grew by 20%. Specialist brands focused on providing green health and beauty products have shown sustained, strong growth outpacing that of the wider health and beauty market (Keynote, 2016). However, brands focused on providing green household cleaning products struggle to enjoy similar successes, reporting substantial losses at year end (Keynote, 2014). This suggests that consumers favour green products in certain product categories, but disfavour them for others. One proposed explanation for this is the sustainability liability. The following research will explore the sustainability liability and its application to household cleaning products. An overview of existing research into the sustainability liability is provided, before identifying and addressing gaps in the literature.

4.2. LITERATURE REVIEW

Section 2.5 discusses at length the ways in which consumers may use the environmental attributes of a product as a heuristic to inform product perceptions and purchase decisions. The reader is to be referred back to here for a review of the literature that informs the piece of research in question. However, a brief summary of the sustainability liability and further discussion of gaps in the literature surrounding it will also be provided here.

4.2.1. The sustainability liability

For low cost, repeat purchase products such as cleaning products, consumers will usually spend little time and effort in ensuring they make the optimal choice (Hoyer, 1984; Leong, 1993; Macdonald and Sharp, 2000). Instead, consumers are content with making a satisfactory choice to minimize the time, effort and energy they expend in making a decision (Thøgersen et al., 2012). In order to do this in a world with greater choice than ever before (Broniarczyk and Griffin, 2014), they must employ simplifying heuristics to the decision-making process (Mai et al., 2019; Thøgersen et al., 2012). Such heuristics could include selecting the lowest priced product, a well-known brand or an item that they have purchased before. A further heuristic in the context of selecting between a green and conventional product is the sustainability liability, initially documented by Luchs et al. (2010).

The sustainability liability suggests that whether or not a product's environmental attributes are perceived as a strength or weakness depends largely on what category the product in question belongs to (Luchs et al., 2010). Consumers must infer unknown information about a product from the information that is provided (Magnier and Schoormans, 2015). Consumers treat these inferences as provisional hypotheses that have the potential to prejudice judgements about a product's missing attributes (Shiv et al., 2005). While environmental attributes might be valued in isolation, they can also affect perceptions of the products other attributes. Socially conscious companies are perceived to be 'safe', 'gentle' and 'protective' (Gildea, 2001). Via the use of an implicit association test, Luchs et al. (2010) prove that individuals associate greater product ethicality with gentleness, and lower product ethicality with strength. Luchs et al. (2010) go on to propose that for products whereby gentleness is a valued attribute, a product's environmental status is viewed as a benefit and thus the green product is likely to be favoured. For products where strength is valued, however, a green product will be viewed as weaker than its conventional counterpart and thus the conventional product will be preferred. This effect remains true even for those who explicitly state concern for environmental and social issues.

A number of studies by Luchs et al. (2010) demonstrate the sustainability liability across a range of different products: car shampoo, baby shampoo and car tyres. The above results were found using hypothetical brands in online surveys. In a separate study, authors then replicated these results supposedly using real products; t-shirts were said to have been washed in either a real green brand of detergent or a real conventional brand and participants were asked to indicate their preference. Both t-shirts were actually washed in a third, unscented brand of detergent and thus not the existing product participants believed the t-shirts to have been washed in. Results indicated that participants believed that the average American consumer would prefer the less sustainable brand of detergent. Finally, the sustainability liability was then confirmed in an observational study using hand sanitizer. When individuals were aware that their choice was being recorded, 78% chose the green hand sanitizer. When individuals were not aware that their choice was being recorded, this dropped to 27%. Both the hand sanitizers were the same product. This result was also replicated by Mai et al. (2019). Taken together, the above studies provide sophisticated evidence for the sustainability liability and hint at its applicability outside of a laboratory environment.

Lin and Chang (2012) extend the research of Luchs et al. (2010) and demonstrate that participants use more of a hand sanitizer when they believe it to be environmentally friendly. The research of Zhu et al (2012) also supports this; they find that participants use more of a hypothetical cleaning product when it is called ‘BalanceGreen’ than ‘BalanceClean’. Lin and Chang (2012) go on to suggest that this effect is stronger for consumers with pro-environmental attitudes, explaining that this is because such consumers are likely to have past experience with green products. Thus, they are aware of the quality differences and therefore use more of the product to account for this. This is demonstrated with mouthwash and glass cleaner (Lin and Chang, 2012).

4.2.2. Limitations of current research into the sustainability liability

There are a number of key limitations to research into the sustainability liability, and these will be outlined as follows. Firstly, none of the current research into the sustainability liability has attempted to explore differences in quality perceptions between existing green and conventional products. Luchs et al. (2010) do somewhat attempt this; in the laundry detergent study they do use existing brands of detergent. However, in reality the t-shirts were actually washed in a third brand of detergent. Thus, the product performance comparison was not actually conducted using existing brands of products. Luchs et al. (2012) note that while consumers believe in a trade-off between sustainability and functional performance, it is unclear whether this trade-off is real or perceived. Some may argue that whether the differences are perceived or real is irrelevant; this may be true in terms of the theoretical base behind the sustainability liability, but it is incredibly relevant for application of the theory to real-life purchase decisions. As such, the sustainability liability must be explored in existing products.

Following on from this, both Luchs et al. (2010) and Lin and Chang (2012) suggest that one way of mitigating the effects of the sustainability liability is to provide explicit information regarding the products effectiveness and strength. Lin and Chang (2012) do so by providing an endorsement from a fictitious organisation suggesting that after scientific product testing, the sustainability enhanced product also displayed superior cleaning performance. For real life products, providing such an endorsement without actually comparing the products in question would be deceptive to consumers. It is hard to reassure consumers of a green cleaning products effectiveness and functional performance if it is unclear whether they perform similarly to conventional cleaning products or not. Thus, the current research aims to address this by comparing existing products widely available for purchase.

Additionally, as the majority of research into the sustainability liability has focused on hypothetical brands, this means that the researcher has manipulated differences between strength and environmental attributes. Again, while this is beneficial to theoretical contributions, it may not be reflective of the way in which existing products are advertised. While green cleaning products are likely to emphasise their environmental features within their packaging, it is possible that there may also be an emphasis on other product features and thus the product may not be advertised as a purely green product. Distinctions between green and conventional products may not be as clear-cut in reality as they are when experimentally manipulated. This provides further justification for the inclusion of existing products into the current research.

The initial research by Luchs et al. (2010) largely involved online surveys, whereby participants did not physically interact with any of the products they were evaluating. Bodur et al. (2015) suggest that the degree to which the sustainability liability affects individuals may be influenced by close physical interaction with the product during consumption. Whilst the research carried out by Lin and Chang (2012) and Zhu et al (2012) did involve participant and product interaction, again the products were identical across conditions and from hypothetical brands. Thus, further research is required to explore the sustainability liability with real products that participants physically interact with.

Finally, little research into the sustainability liability has attempted to address actual product choice. Instead, future purchase intentions are largely used as a proxy for actual purchase behaviour. The mere existence of the attitude-intention-behaviour gap shows that intentions do not always translate into purchase behaviour. While there is evidence for the existence of the sustainability liability, there is a lack of evidence as to whether this influences purchase decisions. This has large implications for the applicability of the research. The current research attempts to address this by including actual product choice as a dependent variable.

4.3. RESEARCH HYPOTHESES

Previous research has largely focused on either hypothetical products, or repackaging and comparing the same product when it is advertised as green or as a conventional product. This research aimed to further explore the sustainability liability using real-life, existing products available to consumers. The following hypotheses are suggested based on the results of previous research.

1. *Participants will rate green products lower when they are aware that they are using a green product compared to when they are not aware of which product they are using.*

2. *When participants are aware that they are using a green product, they will be willing to pay significantly less for it than when they are not aware that they are using a green product.*

3. *When participants are aware that they are using a green product, they will use significantly more of it than when they are not aware that they are using a green product.*

4. *When participants are aware that they are using a green product, they will take significantly longer to clean than when they are not aware that they are using a green product.*

5. *These relationships will be influenced by whether the participant values environmentally friendly attributes in a product.*

6. *These relationships will be influenced by whether the participant values strength attributes in a product.*

7. *Participants will be significantly more likely to select a green product as their reward when they are not aware of which products they are using compared to when they are aware of which products they are using*

4.4. METHOD

4.4.1. Product selection

As the research aimed to explore the sustainability liability in terms of widely available existing products, the first task was identifying which products were to be used in the experiment. Selection criteria was similar to that in Chapter 3. To address the widely available criterion, supermarket websites (ASDA, 2019; Morrisons, 2019; Ocado, 2019; Sainsburys, 2019; Tesco, 2019) were consulted. These retailers were selected as they are the largest supermarkets within the UK; they are the places where the majority of consumers will purchase their cleaning products. Thus, the products stocked there are products that consumers are likely to have used or be familiar with. For the purpose of this research, only multipurpose surface cleaning products were selected, as they were most appropriate for the cleaning tasks the participants would be completing. A product was considered for inclusion if it was available on three or more of the online supermarket websites[5].

4.4.1.1. Green products

As in Chapter 3, a product was considered green if it made a claim such as 'green', 'organic', 'non-toxic', 'environmentally/eco-friendly', 'plant-based' or 'natural' on its' label. A product was also classified as green if its name or brand name made reference to the environment. While this may end up including greenwash products, it is argued that the average consumer would be unaware of this. The average consumer would see reference to the environment within the product advertising or name and assume it is an environmentally preferable product. As this study aimed to explore consumer perceptions, products perceived to be green are as relevant to include as those that meet more stringent eco-labelling criteria. Two green cleaning products were widely available; Ecover Multi Surface Cleaner Spray and Method Lavender Scent Multi Surface Spray. Thus, these two products were selected as the green products for the experiment.

5: At the time of study design, all of the products were available on at least three of the supermarket websites. However, between study design and time of writing, three of the products are now available on two websites. These products are: Flash, Cif and Mr Muscle.

4.4.1.2. Conventional products

Unlike with green cleaning products, there was a wealth of conventional cleaning products that met the inclusion criteria for the research. Thus, it was decided to include a product that represented each of the main manufacturers of household cleaning products: Unilever, Procter & Gamble, Reckitt Benckiser and SC Johnson. The most commonly available product for each brand was selected. For Unilever, Cif Power and Shine All Purpose Cleaner was selected. For Procter and Gamble, this was Flash All Purpose Spray Cleaner (Crisp Lemons). For Reckitt Benckiser, Dettol Antibacterial All Purpose cleaner was selected. For SC Johnson, this was Mr Muscle All Purpose Cleaner Citrus Lime. Further details of all of the products included in the research can be found in the appendices (Appendix 1).

4.4.2. Soil selection

One of the aims of this research was to replicate the home cleaning environment as closely as possible. Little research on cleaning products has involved observing participants clean in such an environment. Thus, following the early research of Kovacs et al. (1997), items from the kitchen of a typical consumer were explored for their possibility for inclusion. The study aimed to identify a different selection of stains for participants to clean that were varied in degrees of difficulty to remove. A number of different items were initially considered; ketchup, barbeque sauce, jam, balsamic vinegar, olive oil, tea, coffee, soy sauce, curry sauce, gravy and honey, among others. A 2.5mg application of each item was allowed to air dry on a standard kitchen surface to assess their difficulty in removal. Items were disregarded if they took too long to dry on the surface, hindering the practicalities of including them in the study, or if they were too easily removed (e.g. wiped away quickly with one swipe of a cloth). Of these, tea, jam, curry sauce, barbeque sauce and balsamic vinegar were selected for inclusion as they each presented different challenges for cleaning. However, after pilot testing, tea and balsamic vinegar were dropped from the experiment to reduce the participant burden. Throughout the duration of the research, the same brand of jam, barbeque sauce and curry sauce were used. Further information on the items used to create stains for the participants to clean can be found in the appendices (Appendix 2).

4.4.3. Materials

Two questionnaires were developed for the study. Copies of these in full can be found in the appendices (Appendix 3). The first questionnaire assessed demographics and current cleaning behaviour. It asked whether participants were responsible for cleaning in the home, whether they were responsible for buying cleaning products, how often they cleaned their surfaces, how often they purchased cleaning products and which cleaning products they were familiar with using. Participants were asked to indicate the three most important qualities to them in a cleaning product from the following list: price, quantity, brand, scent, colour, strength, whether the product was on offer, whether they had used the product before, whether the product was advertised as eco-friendly, and whether the product was advertised as suitable for sensitive skin.

The second questionnaire was designed so that the participant could rate each of the cleaning products that they had used on a number of attributes. Using a 1-10 Likert scale, participants rated each product on the following dimensions: ease of use, speed, efficiency, long-lastingness, scent, perceived quality and future purchase intentions. These are qualities that have been previously identified as important to consumers when considering a cleaning product (Keynote, 2014). They were also asked to indicate how much they would be willing to pay for a 500ml bottle of each cleaning product used. It is acknowledged by the author that asking participants to state how much they would be willing to pay for a product is unlikely to be a true reflection of how much the participants would actually pay for a product in a purchase environment. However, due to the importance placed upon price for cleaning products, it felt necessary to gain some form of understanding – albeit flawed – of the monetary value that participants felt the product to represent. As it would have been impractical and unethical to require participants to actually pay for the products, asking them to indicate their willingness to pay for each product was the only way to gain some form of insight into the financial considerations of each product.

4.4.1. Experimental Procedure

4.4.1.1. Study set up

Prior to participant arrival, the soiled trays were prepared. 2.5mg of each soil item was measured out using a measuring spoon and levelled off. These were applied to the tray, and then the measuring spoon was moved in a clockwise circular direction three times to spread the soil on the tray. This was repeated for the jam, curry sauce and barbeque sauce, with the measuring spoon rinsed and dried between each item. This was then repeated six times, so that there was a jam, curry and barbeque stain for each product to be used. The stains were spread out over two trays; one row of curry sauce, barbeque sauce and jam for each product, with six products in total. There were three rows per tray. Appendix 4 shows this in more detail. The trays were then put into a preheated oven at 90°C for 45 minutes. An oven was used as opposed to air-drying in order to assist with the speed of this experiment and allow for more than one participant to take part per day. The trays were then taken out of the oven and allowed to cool for 15 minutes prior to participant arrival. The cleaning products to be used in the experiment were weighed, and their weights were recorded.

4.4.1.2. Participant procedure

Participants were to be randomly allocated to one of two conditions; in the ‘aware’ condition, participants were presented with the six products in their original packaging. In the ‘blind’ condition, participants were presented with the products in identical plain white 500ml bottles so that they would not know which products they were using. Participants were not made aware that there were separate conditions until the end of the study. For each participant, the order of the six cleaning products used was changed to avoid any potential order effects.

Upon arrival, participants were first given an information sheet about the study to read before signing a consent form. This information sheet did not reveal the true aims of the study; participants were informed that they were taking part in a consumer behaviour study that was exploring cleaning product preferences. Following this, they were given some information about how to safely use the cleaning products. They were then presented with the initial demographic questionnaire. Once this was completed, the participants moved onto the cleaning tasks. In both the aware and blind conditions, the participants were presented with the cleaning products in a random order. They were instructed to work along the row of stains from left to right, with jam first, curry sauce second and barbeque sauce third. They were instructed to alert the researcher once they had finished each stain, so that the time it had taken them to clean and the weight of the product could be recorded. Once they had completed one full row of stains, they were asked to complete the second questionnaire that involved rating the product across a number of attributes. This was repeated for all six products. Once the participant had completed all of the cleaning tasks for all of the products, they were asked to select which product they had liked the most and wished to receive as their reward for taking part. They were also asked for their reasons for this choice, which were recorded. After this, the participant was debriefed about the true aims of the study and the experiment was complete.

The procedure for both the aware and blind conditions was identical, apart from one difference. In the aware condition, when presenting the participant with each product, the researcher would introduce the product. For a conventional product, the product would be introduced as “This is Flash/Dettol/Cif/Mr Muscle, a well known brand of surface cleaning product”. For a green product, the product would be introduced as “This is Ecover/Method, an environmentally friendly brand of surface cleaning product”. This was done to ensure the participants identified the difference between the green and conventional brands. In the blind condition, the participants received no information regarding the cleaning products they were using.

4.4.5. Participants and recruitment

Participants were recruited via online and physical advertisements. Posters advertising the study were placed on prominent locations around campus. These posters were also distributed via mailing lists, and advertised on internal websites. The posters did not reveal the true aim of the study; the study was advertised as a 'consumer behaviour study' to try minimise demand characteristics. To ensure a wider sample, the cleaning staff at the University of Leeds were also approached and provided with information about the study to decide if they wished to take part. Recruitment proved slower than anticipated, so a snowball sample technique was also utilised with participants being asked to share details about the research to individuals they thought might be interested. Recruitment took place between June-2016 and July-2018.

4.5. RESULTS

4.5.1. Sample information

In total, 70 participants completed the experiment. 34 were assigned to the aware condition, 36 to the blind condition. 65.7% of participants were between 18-35. 58.6% were female and 52.9% identified their ethnicity as white British. 71.5% of participants were educated to at least undergraduate level. When considering these results, it should be taken into account that this is not entirely representative of the UK population due to high education levels.

4.5.1.1. Cleaning behaviour

The majority of participants – 72.9% - indicated that they were responsible for purchasing the cleaning products used in their household. 67.1% of participants were also the main person responsible for cleaning in the home. Cleaning products were purchased either once a month or less for 61.1% of participants. Most participants used cleaning products either daily (28.6%), every other day (18.6%) or weekly (34.3%).

4.5.1.2. Important qualities in a cleaning product

Participants were asked to indicate the three most important qualities to them in a cleaning product. The results are shown in Figure 4. 23 participants indicated that green qualities were important to them in a cleaning product, 47 did not. 23 participants indicated that strength was important to them in a cleaning product, 47 reported that strength was not important to them.

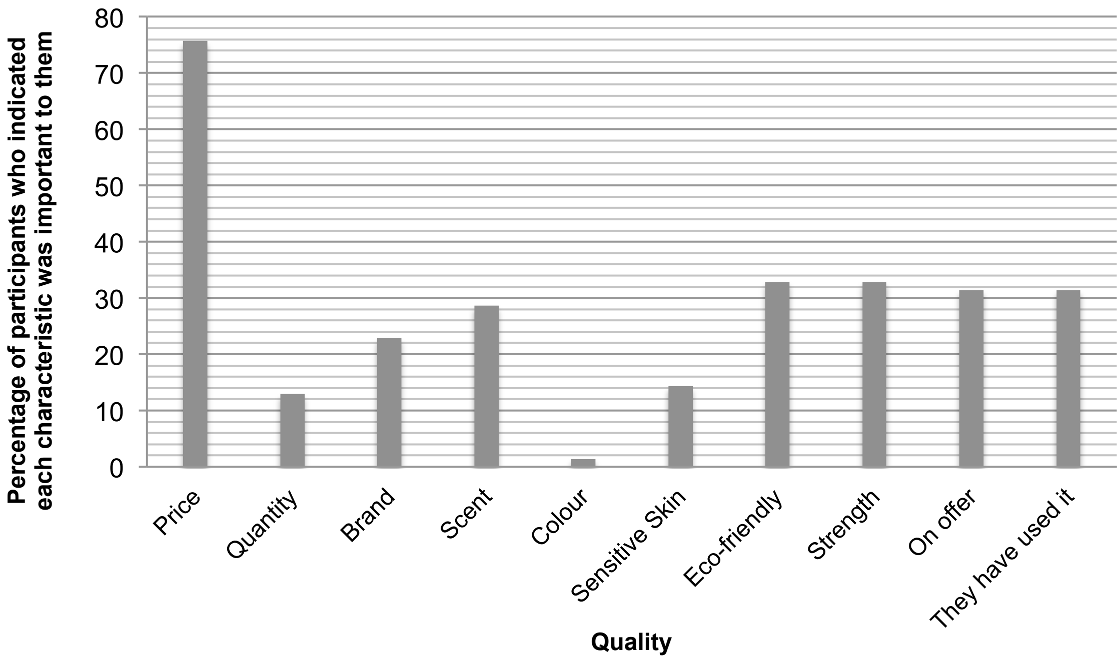

Figure 4: Important qualities in a cleaning product

4.5.2. Descriptive statistics

The mean and standard deviation was calculated for the total rating for each product, willingness to pay for each product, the total amount of each product used and the total time taken to complete the cleaning tasks with each product. These are shown in Table 9.

Table 9: Descriptive statistics for each of the products

Product	Total Rating		Willingness to Pay (pence)		Amount used (g)		Total time (seconds)	
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
Mr Muscle	48.32	11.17	193.23	103.87	4.11	2.25	81.98	30.39
Dettol	50.51	12.18	200.01	115.94	4.53	2.43	80.7	31.42
Ecover	49.1	10.69	197.05	98.47	3.86	2.11	84.51	31.42
Flash	49.92	10.59	182.54	72.39	4.18	2.21	83.12	31.96
Method	50.64	11.65	212.7	106.89	4.02	1.86	86.13	30.69
Cif	49.13	11.25	192.271	91.41	4.48	2.37	85.01	34.04

4.5.3. Differences between conditions

Each of the different characteristics of which the participants rated the products on were highly correlated (Appendix 5). Thus, for the purpose of analysis the total score for each product for each participant has been calculated. Willingness to pay has been analysed separately due to it being measured in different units to the rest of the questions. Participants were categorised as green consumers if they identified that a product being environmentally friendly was important to them. The data were analysed using a 2 (aware/blind) x2 (green consumer/not green consumer) x6 (product) mixed design ANOVA.

4.5.3.1. Demographics

There were no significant differences between conditions on participant age χ^2 (7) = 6.692, p=.462, gender χ^2 (2) = .968, p=.616, ethnicity χ^2 (5) = 4.956, p=.421 or education χ^2 (6) = 3.483, p=>.746.

4.5.3.2. Total product rating

- There was a significant main effect of condition on total product rating F(1, 68) = 6.183, p=<.05. Overall, products were rated significantly higher in the aware condition (M=52.049, SE = 1.369) than in the blind condition (M=47.301, SE = 1.331). None of the products differed significantly from each other on their mean ratings F(5, 68)= 1.907, p=>.093.
- There was no significant interaction between condition and product used F(5, 68)=1.277, p=.273. There was a significant interaction between product used and whether green products were important to the participant F(5, 68)=4.063, p=<.001. This is shown in Figure 5. Error bars on the figure refer to the standard error.

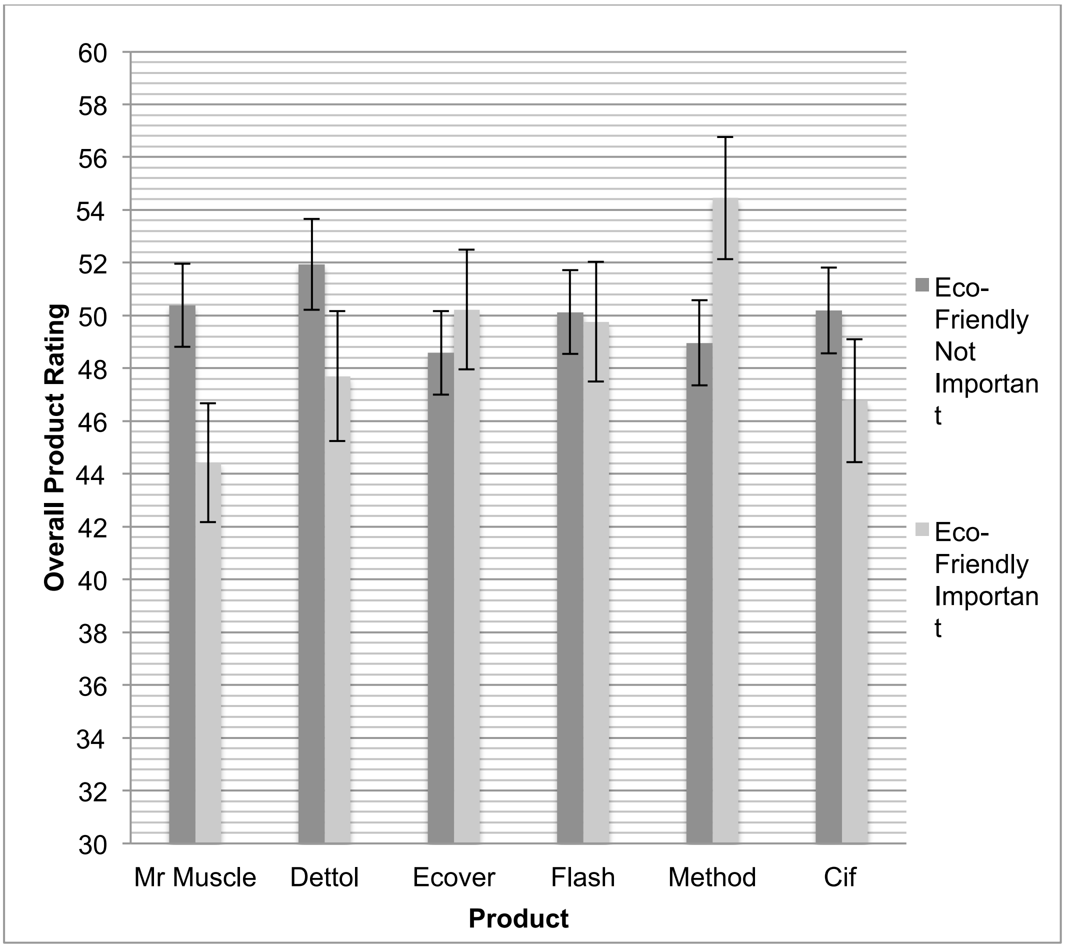

Figure 5: Interaction between the effect of product and whether green products are important to consumers or not on product rating

4.5.3.3. Willingness to pay

For this analysis, Mauchly's test for sphericity was significant $\chi^2(14)=58.018$, $p=<.001$. Thus, the Greenhouse-Geisser corrected values will be reported.

- There was a significant main effect of condition on willingness to pay $F(1, 66)=12.936$, $p = <.001$. Overall, participants were willing to pay significantly more for each product in the aware condition ($M = 224.024$, $SE = 13.128$) than in the blind condition ($M=167.385$, $SE = 13.236$).
- There was also a significant main effect of product used on willingness to pay $F(3.687, 243.36) = 3.635$, $p=<.01$. Bonferroni post-hoc analyses revealed that participants were willing to pay significantly more for Method ($M=225.93$, $SE = 11.625$) than Mr Muscle ($M=191.414$, $SE =$

12.99), Flash (M=183.944, SE = 9.372) and Cif (M=191.521, SE = 11.190), p = <.05.

- There was a significant interaction between product used and condition on willingness to pay F(3.687, 243.356)= 2.928, p=<.05. The results from this are shown in Figure 6. Error bars on the figure refer to the standard error.

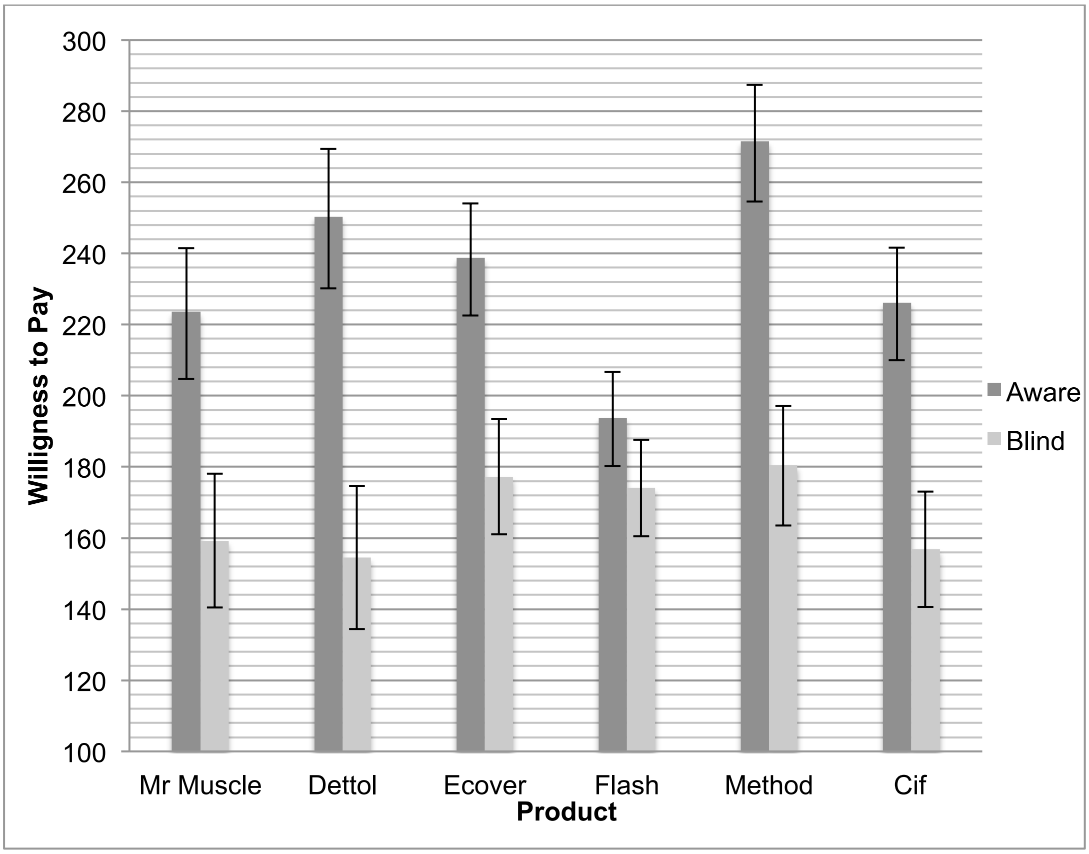

Figure 6: Interaction between product and condition on willingness to pay

- There was a significant interaction between the product used and whether green products were important to the participant on willingness to pay F(3.687, 243.356)= 6.149, p=<.001. The results from this are shown in Figure 7. Error bars on the figure refer to the standard error.
- There was no significant interaction between product used, condition and whether green products were important to the consumer F(3.687, 243.356)=1.075, p=.367.

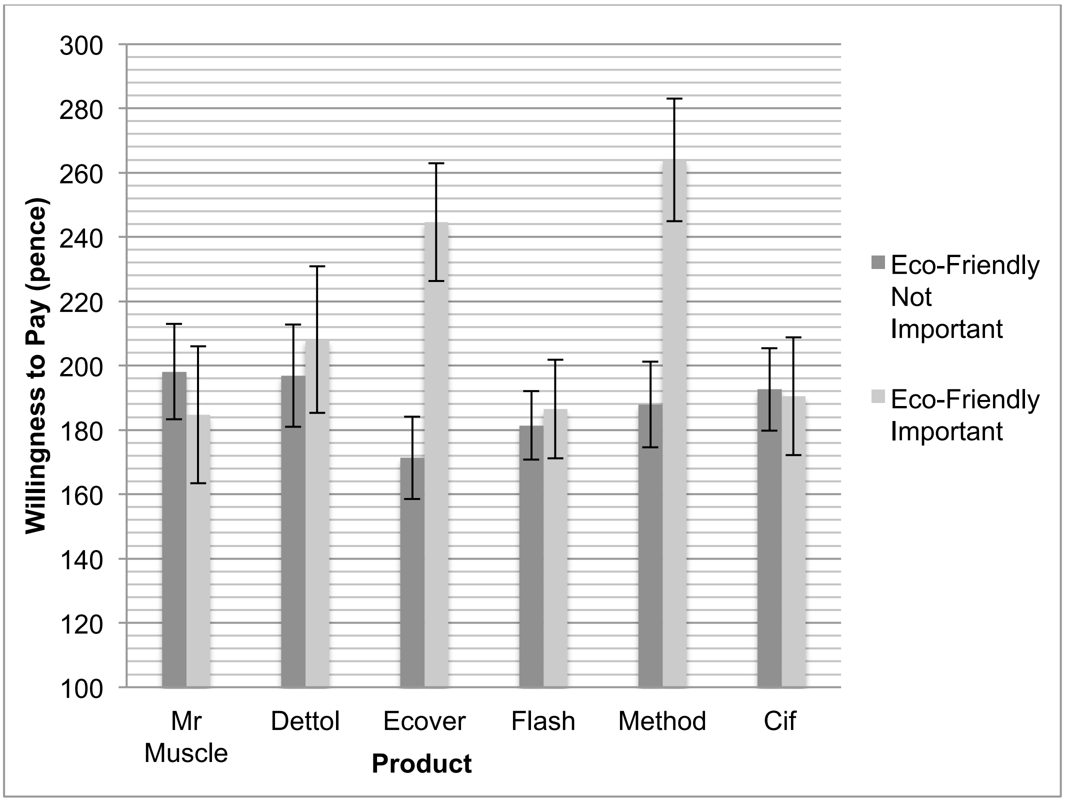

Figure 7: Interaction between product and whether green products are important to the participant on willingness to pay

4.5.3.4. Total amount of product used.

- There was no significant main effect of condition on total amount of product used F(1,66)=.129, p=.720.
- There was a significant main effect of product on total amount of product used, F (5,330)=2.816, p=<.05. However, when looking at the follow-up contrasts, none of these differences held after a Bonferroni correction was applied for multiple tests.
- There was also a significant interaction between product and condition F(5, 330)=4.489, p=<.01. Figure 8 shows this. It appears that in the aware condition, participants used significantly more Dettol than Ecover. Error bars on the figure refer to the standard error.

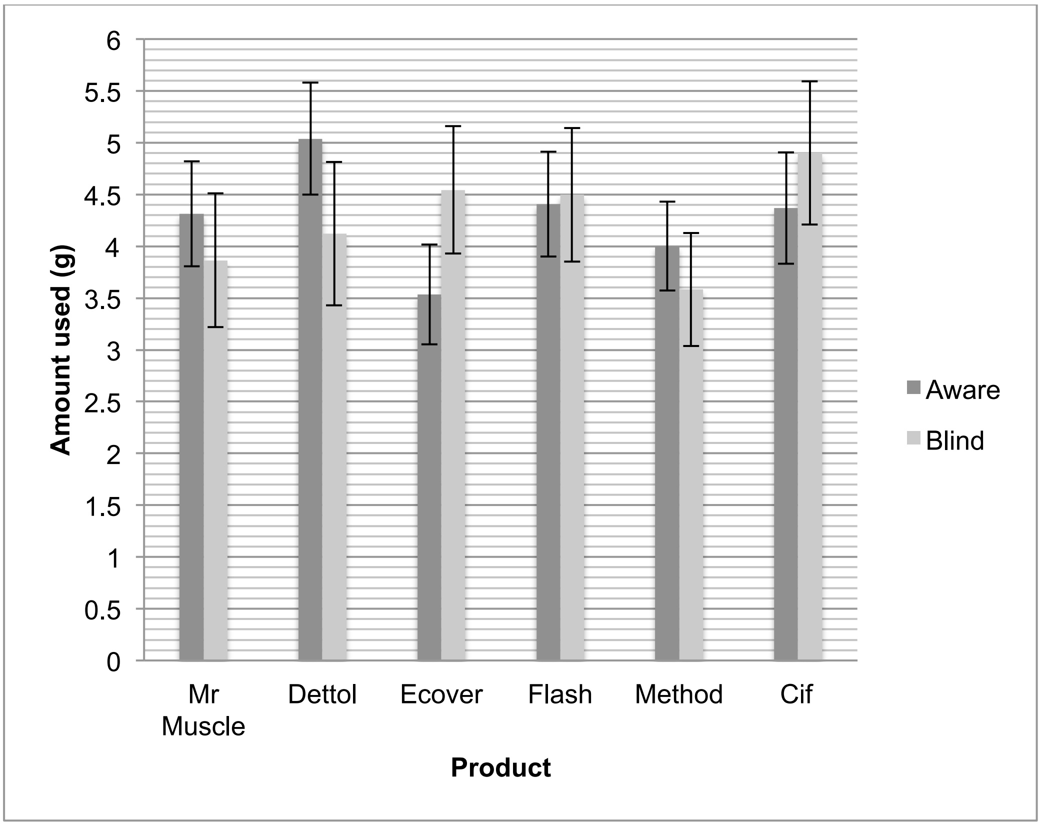

Figure 8: Interaction between product and condition on total amount used

- There was no significant main effect of whether green products were important to participants on total amount of product used F(1,66)=.574, p=.451.
- There was also no significant interaction between product used, condition and whether green products were important to participants F(5,330)=.177, p=.986.

4.5.3.5. Total time taken to clean

- There was no significant main effect of condition on total time taken to clean F(1,66)=2.694, p=.106.
- There was no significant difference between products on total time taken to clean F(5,330)=.534, p=.750.
- There was no significant main effect of whether green products were important to participants on the total amount of time taken to clean F(1,66)=3.792, p=.056.

- There was no significant interaction between product and condition on total time taken to clean $F(5,330)=.508$, $p=.770$.
- There was no significant interaction between products and whether green products were important to the participant on total time taken to clean $F(5,330)=1.336$, $p=.249$.
- There was no significant interaction between condition and whether green products were important to participants on total time taken to clean $F(1,66)=3.792$, $p=.056$.
- There was a significant three way interaction between products, condition and whether green products were important to participants on total time taken to clean $F(5,330)=3.848$, $p=<.01$. This is shown in Figure 9. Error bars on the figure refer to the standard error.

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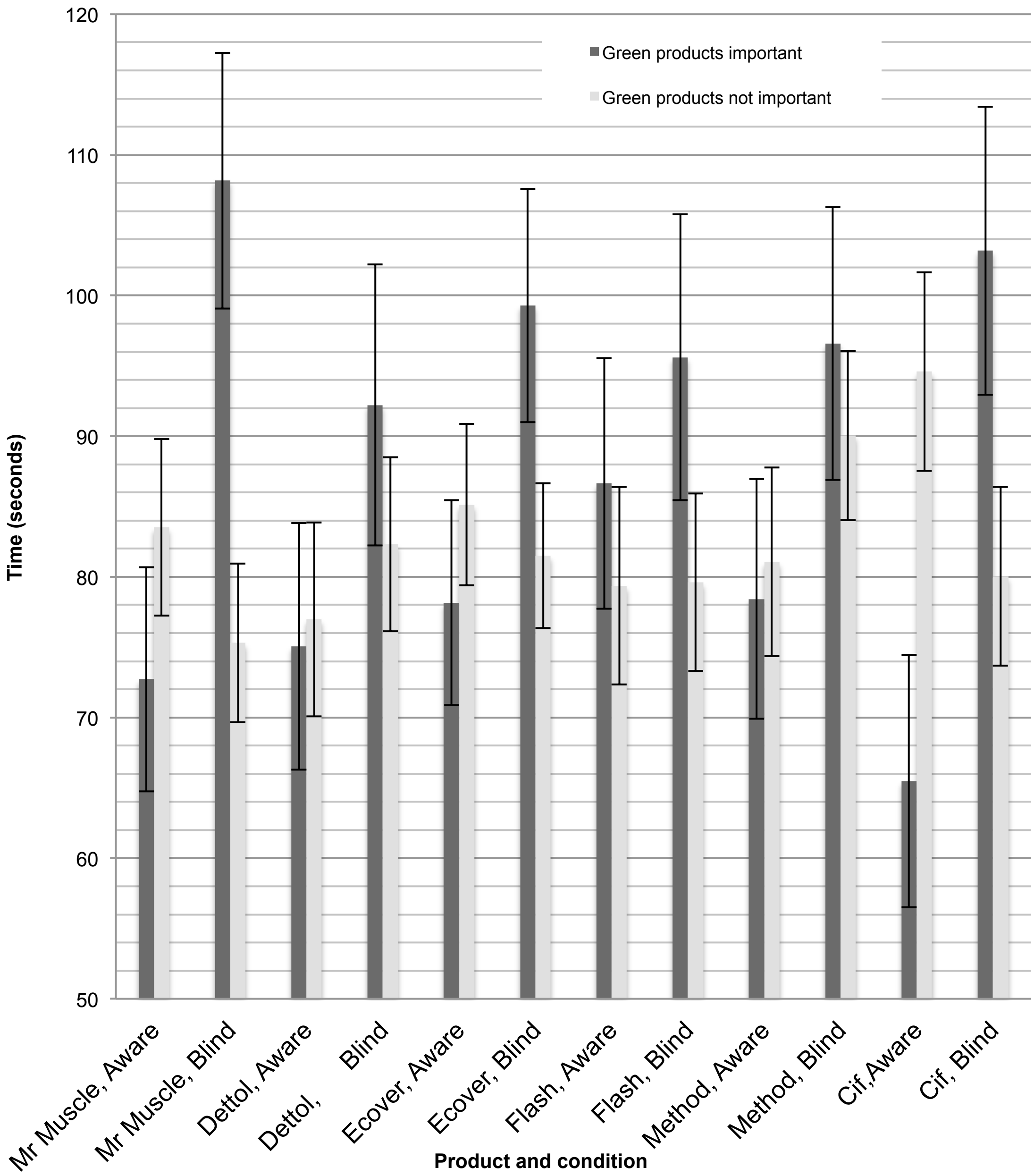

Figure 9: The three-way interaction between product, condition and whether green products are important to participants on total time taken to clean

4.5.4. The role of strength

The data were then analysed to explore whether valuing strength in a product had an effect on the results. The data were analysed using a 2 (aware/blind) x2 (values strength/does not value strength) x6 (product) mixed design ANOVA.

4.5.4.1. Total product rating

- There was no significant main effect of valuing strength on total product rating $F(1,66)=.027$, $p=.869$.
- There was no significant interaction between products and valuing strength on total product rating $F(5,330)=1.208$, $p=.305$.
- There was no significant interaction between condition and valuing strength on total product rating $F(1,66)=.017$, $p=.898$.
- There was no significant interaction between condition, product and valuing strength on total product rating $F(5,33)=.958$, $p=.444$.

4.5.4.2. Willingness to pay

For this analysis Mauchly's test of sphericity was significant $\chi^2(14)=61.534$, so the Greenhouse-Geisser corrected values will be reported.

- There was no significant main effect of valuing strength on willingness to pay $(1,66)=.404$, $p=.527$.
- There was no significant interaction between product and valuing strength on willingness to pay $F(3.711, 244.912)=1.890$, $p=.118$.
- There was no significant interaction between condition and valuing strength on willingness to pay $F(1,66)=1.384$, $p=.244$.
- There was no significant interaction between product, condition and valuing strength on willingness to pay $F(3.711, 244.912)=.805$, $p=.515$.

4.5.4.3. Total amount of product used

- There was no significant main effect of valuing strength on total amount of product used $F(1,66)=.250$, $p=.619$.
- There was no significant interaction between products and valuing strength on total amount of product used $F(5,330)=1.408$, $p=.221$.
- There was no significant interaction between condition and valuing strength on total amount of product used $F(1,66)=.263$, $p=.610$.
- There was no significant interaction between product, condition and valuing strength on total amount of product used $F(5,330)=.510$, $p=.769$.

4.5.4.4. Total time taken to clean

- There was no significant main effect of valuing strength on total time taken to clean $F(1,66)=.329$, $p=.711$.
- There was no significant interaction between product and valuing strength on total time taken to clean $F(5,330)=1.612$, $p=.162$.
- There was no significant interaction between condition and valuing strength on total time taken to clean $F(1,66)=.329$, $p=.568$.
- There was no significant interaction between product, condition and valuing strength on total time taken to clean $F(5,330)=1.742$, $p=.124$.

4.5.5. Product chosen

4.5.5.1. Overall product choice

One participant abstained from choosing a product. Out of the 69 participants who did select a product, Method proved to be the most popular of the products overall, with Dettol the second most popular. Flash, Cif and Mr Muscle fared similarly to each other, with Ecover being the least selected product.

4.5.5.2. Differences between conditions

Product selection was then explored across the two different conditions. Figure 10 shows the differences in the percentage of participants who chose

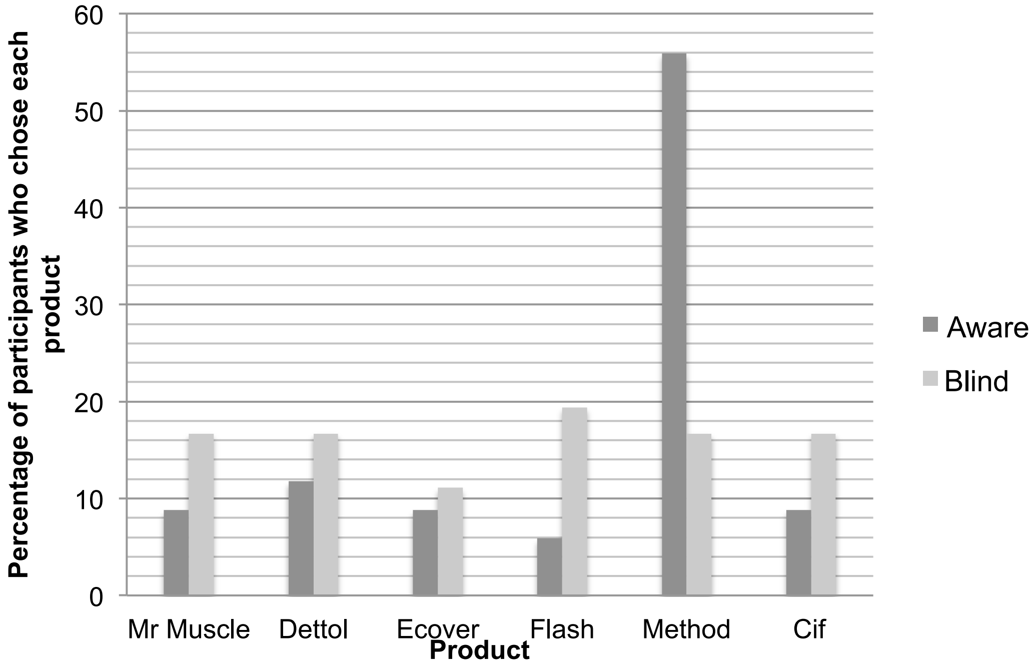

Figure 10: Differences in product chosen across conditions

each product across the two conditions. A chi square test showed that condition had a significant effect on product chosen χ^2 (6) = 13.034, p = <.05. Further inspection showed that in the aware condition, significantly more participants chose Method than was expected, and in the blind condition, significantly fewer participants chose Method than was expected.

4.5.6. Reasons for product choice

To further explore the results of the chi-square test discussed in 4.5.5.2, the reasons participants gave for choosing their product were analysed qualitatively. Participants were allowed to provide as many reasons as they wished for their product choice. These will be discussed across the two conditions separately. Not all participants provided a reason for their product selection.

4.5.6.1. Reasons for product choice – blind condition

When participants were unaware of which product they were using, unsurprisingly the reasons they gave for their product choice were largely performance related qualities, such as efficiency, speed, effectiveness, strength and ease of use. These reasons were relatively stable across each product, with most participants citing their selected product as the quickest/most efficient/strongest/most effective. The only cited reason that was not related to product performance was scent. Scent has no functional role within a product, yet the majority of participants in this condition cited scent as a reason for their product selection. Figure 10 shows how across the blind condition, product selection was relatively stable. Thus, if scent was a deciding factor for participant product choice, this shows that scent preferences are highly personal.

4.5.6.2. Reasons for product choice in the aware condition

In the aware condition, participants had much more information about the products that they could use to base their decision on. This was reflected in the reasons cited for product choice. Four overall themes were identified: performance related aspects, sensory aspects, environmental aspects and novelty. Performance related aspects were similar to in the blind condition: efficiency, speed, effectiveness, strength and ease of use. Frequency of these reasons was similar across all products.

Sensory aspects related to product appearance and scent. Similar to the blind condition, scent was a widely cited reason for product choice. With Ecover as an exception, every product was reported to have been chosen for its scent by at least one of the participants who provided a reason for their product selection. One participant who selected Method described the lavender scent as taking “the drudgery out of cleaning”. Aesthetics and packaging were also cited as reasons for product selection, mainly for those who selected Method. Method was frequently described as “looking nice” or coming in “nice packaging” or as being a “nice colour” (purple).

Environmental aspects related to a reason somewhat related to the environmental credentials of the product. This included selecting the product because it was advertised as green, comments on quality perceptions in relation to the environmental status of the product, and comments on the perceptions of chemicals in products. These will be discussed in more depth in the following section.

A final theme was that of novelty; this was strictly restricted to the Method product. A number of participants cited selecting Method due to it being a new product that they hadn't tried before and wanting to test it out. One participant explicitly stated that they "wanted to try it for free because it is expensive".

4.5.6.2i. Environmental reasons for product choice

There were three separate aspects to participants' reason for product selection that linked to the environment, and these warrant discussing in more depth. As participants were unaware of the product's environmental status in the blind condition, this section largely discusses participant reasons in the aware condition. It should also be noted that the one participant who refused to select a product did so on environmental grounds. They were allocated to the blind condition and did not wish to choose a product, as they believed none of them were environmentally preferable.

The first reason simply related to individuals selecting one of the green products due to it being clearly advertised as a green product. Method was the most commonly selected green product, and two participants cited that they selected Method as it "was the best of the two eco-ones". Many others cited factors such as "non-toxic", "ethical", "eco/plant-based" as reasons for their selection. Those who selected Ecover also stated its' "eco-friendly" status as a reason for their selection.

The second aspect covered quality perceptions in relation to the product's environmental status. Here, limited evidence for the sustainability liability is hinted at. Two out of the three participants who left reasons for selecting Ecover mentioned being surprised at how well the product worked. Participant 5 stated that they weren't "expecting it to be as good [as others], but when you know it's as good as branded [products] you will choose it". Participant 48 believed Ecover to be a cheap product based on it's packaging and environmental status, but were surprised at how well it worked when they used it as it was the quickest of all the products. This was also the case for the popular Method product. Participant 16 believed the product would be "bad quality", but was surprised when they used it. Participant 64 was surprised at "how good it is, being eco-friendly". One participant who selected Dettol stated that "It cleaned better than the eco-friendly ones, otherwise I would have chosen one of those". This suggests individuals may have had preconceived notions of the quality of green cleaning products prior to the study, but for some individuals, using the products is enough to alleviate these perceptions.

The final aspect related to consumer perceptions of chemicals. Stated reasons relating to this were restricted to the Method product. This aspect interacted closely with perceptions of the product's scent. Of those who selected Method as their product, a number of participants did so due to it "not smelling as chemically". The Method product was scented with lavender, which may fit with preconceptions that it was a plant-based product. Interestingly, one participant in the blind condition believed she had identified one of the products as a green product due to its lack of scent. "[I was] amazed by Product ♯6, which appears to be an eco-product because it is odourless. This product had the same cleaning result as the product I have chosen. If this product was cheaper than ♯6, I would buy it". The participant had incorrectly identified Dettol as a green cleaning product due to its lack of odour. The product they had actually selected was Ecover, which they had selected due to its "more exciting" scent. In the aware condition, one participant stated that they chose Method as it "cleaned better than Ecover and they had a preference for an eco one. Dettol was the best out of the more chemical ones". This demonstrates a clear distinction for participants between green and conventional cleaning products; in the eyes of the consumer, conventional cleaning products contain chemicals and green cleaning products do not. This misperception is at odds with scientific principles and will be discussed further in section 4.6.2.2.

4.6. DISCUSSION

4.6.1. Summary of results

In order to discuss the results in relation to the hypotheses, the hypotheses shall be restated here:

1. *Participants will rate green products lower when they are aware that they are using a green product compared to when they are not aware of which product they are using.*

2. *When participants are aware that they are using a green product, they will be willing to pay significantly less for it than when they are not aware that they are using a green product.*

3. *When participants are aware that they are using a green product, they will use significantly more of it than when they are not aware that they are using a green product.*

4. *When participants are aware that they are using a green product, they will take significantly longer to clean than when they are not aware that they are using a green product.*

5. *These relationships will be influenced by whether the participant values environmentally friendly attributes in a product.*

6. *These relationships will be influenced by whether the participant values strength attributes in a product.*

7. *Participants will be significantly more likely to select a green product as their reward when they are not aware of which products they are using compared to when they are aware of which products they are using.*

There was a significant main effect of condition on the product rating; all products were rated significantly higher when participants were aware of which products they were using than when they were not. There was no significant main effect of which product the participants were using on product rating, thus suggesting each product performed similarly. This suggests that any potential differences in quality between green and conventional cleaning products are perceived rather than real. There was no interaction between condition and product on total product rating, which to provide evidence for the sustainability liability would have been expected. Thus, Hypothesis 1 is unsupported. There was a significant interaction between identifying as a green consumer and product; self-identified green consumers rated Method significantly higher than conventional consumers.

There was a significant main effect of condition on willingness to pay; for all products but Flash, participants were willing to pay significantly more for each product when they were aware of which product they were using than when they were not. This may suggest a role of branding or product aesthetics on willingness to pay. There was also a significant main effect of product, and a significant interaction between product and condition. In the blind condition, willingness to pay between products did not differ significantly. However, in the aware condition, participants were willing to pay significantly more for Method than they were for Cif, Mr Muscle and Flash. This is the opposite finding of what was expected in terms of the sustainability liability. Thus, Hypothesis 2 is unsupported.

There was no significant main effect of condition on total amount of product used, suggesting that participants in the aware and blind condition used a similar amount of product. The significant interaction between product and condition suggested that participants used significantly less Ecover than Dettol, but only in the aware condition. Again, this is the opposite finding of what would be expected in terms of the sustainability liability and Hypothesis 3 is unsupported.

For total time taken to clean, there were no significant main effects of condition, product or whether green products were important to consumers. There was a significant interaction between product, condition and whether green products were important to consumers, but this interaction did not show distinct differences between green and conventional products. Hypothesis 4 is therefore unsupported.

Identifying as a green consumer resulted in increased willingness to pay for green products, as well as an increased total rating for one of the green products. Thus, Hypothesis 5 was partially supported.

Valuing strength in a product did not significantly impact the overall rating of the product, willingness to pay, the amount of product used while cleaning or the total amount of time taken to perform the cleaning tasks. Thus, Hypothesis 6 is unsupported.

In terms of product choice, there was a significant effect of condition. In the blind condition, each of the products was chosen at a similar frequency. However, in the aware condition, Method was chosen significantly more frequently than any of the other products. As Method is a green brand of product, this is the opposite of what was hypothesised. Hypothesis 7 is therefore unsupported.

4.6.2. Discussion of findings

4.6.2.1. The sustainability liability

The results of the current research largely contradict findings of previous research into the sustainability liability. This indicates a more optimistic reality for green strength-valued products than has previously been suggested. The sustainability liability would suggest that green products are associated with being safe, friendly, protective and gentle (Gildea, 2001). For products whereby strength is valued – cleaning products are often cited as an example

(Luchs et al., 2010) – consumers should favour conventional products over green products. This has been demonstrated for hypothetical products, or for identical products that have been manipulated to be advertised as green or as a conventional product. The current research using widely available existing products found evidence to the contrary. Understanding the reasons underlying this is imperative to future research into the sustainability liability. A number of potential reasons will be discussed.

It has largely been assumed that consumers will value strength in a cleaning product; the stronger a cleaning product, the greater the hygiene and therefore safety of the home. However, for surface cleaning products this has not actually been demonstrated. The current research suggests strength and eco-friendly attributes were equally as important to consumers when selecting a surface-cleaning product (Figure 4). This could be due to consumer concern with the environment, and it could also be a result of increasing consumer concern about 'chemicals'. Cleaning solutions once viewed as ensuring the good health of a family by eradicating germs are now seen as dangerous chemicals, posing threats to the health of anybody who resides in a home where said product was used (Martens and Scott, 2005).

Correctly or incorrectly, green products are often viewed as a safer alternative to conventional products; consumers may view green cleaning products as a solution to this conflict. Consumers require a product that does the job, but at minimal risk to personal and familial health. This is reflected in the reasons some participants gave for selecting Method; one participant stated "I don't have contact with terrible dirt so mainly want soap and water anyway." Other participants selected Method due to it smelling "less chemically". If strength is not as universally valued in a cleaning product as was previously assumed, it makes sense that the effects of the sustainability liability were limited in this context. The current research suggests that while some consumers may value strength, this does not influence their perceptions or use of household cleaning products.

Previous research into the sustainability liability has often focused on surveys whereby participants do not physically interact with the product (Luchs et al., 2010). Studies that have involved participants interacting with a product have involved using identical hypothetical products, with their advertising materials manipulated to emphasise strength or environmental attributes only (Lin and Chang, 2012). Such experimental manipulation is likely to be more pronounced than the differences in packaging between existing products. This study involved exploring the sustainability liability in a more realistic setting: getting participants to compare a range of different existing products with no change to their marketed packaging. Thus, the differences between strength and environmental attributes may not have been as exaggerated as in previous research. It was clear that the participants perceived no real differences in strength between the products, as there were no significant differences between products for participants who valued strength in a product and those who did not. This could have contributed to the lack of supporting evidence for the sustainability liability found in this research. This would suggest that the sustainability liability may not be as prominent for real-life, existing products as it is for experimental hypotheticals. This has implications for the applicability of the previous research into the sustainability liability.

A further explanation for these results may provide some evidence for the sustainability liability. Cleaning products are functional products; that is, they are purchased for their ability to complete a task. Thus, the product must perform this task to an acceptable level in order to satisfy the consumer. Even green consumers value a product's functional performance over environmental attributes until an acceptable threshold level of functional performance has been reached (Luchs et al., 2012). In this study, there was no overall main effect of product, suggesting that participants perceived each of the products to perform similarly on the cleaning tasks. However, the participants' reasons for product choice do suggest that the participants came into the study with some preconceptions about green cleaning products. For participants who chose both Ecover and Method, a number of them mentioned 'surprise' at how well each product performed especially in comparison to the conventional products. It is thus possible that prior to using the products, participants did perceive green cleaning products to be less effective than conventional cleaning products. However, after using each of the products and believing them to perform similarly, these preconceptions were alleviated and participants were pleasantly surprised with the green products. All of the products reached an acceptable level of functional performance, and thus participants felt comfortable in selecting a green product without feeling like they were compromising.

While Method was popular with participants, Ecover was the least selected product. This was in spite of there being no significant difference between overall product ratings. If the products were perceived to perform similarly, why was Method so overwhelmingly popular? One potential explanation could be in product aesthetics. Consumers use packaging to identify, categorize and differentiate products (Magnier et al., 2016; Magnier and Schoormans, 2015). One participant who selected Ecover suggested that they were surprised by its performance; they believed the product would be of poor quality due to its' "bad packaging". Participants who selected Method frequently cited its' "nice packaging" as a reason for their selection. Figures 11 and 12 show the differences in appearance between Ecover and Method: it could be argued that Method appears to be a more aesthetically pleasing product. This may have suggested a higher product quality to participants.

Figures 11 and 12: Differences in packaging between Ecover (11) and Method (12) (Tesco, 2019)

Such an idea is supported by research from Luchs et al. (2012), who demonstrated that a phone marketed as sustainably superior was significantly more likely to be chosen when the phone also had a distinct aesthetic advantage. Superior aesthetic design has been found to have a disproportionately positive effect on the likelihood of individuals choosing a green product. Individuals may be nervous about selecting a green product over a conventional product due to its perceived inferiority. A superior aesthetic design alleviates this anxiety and increases confidence in the green products functional performance. It is thus possible that participants perceived Method to be more aesthetically pleasing than Ecover and selected it due to a combination of its aesthetic and environmental attributes. This could also explain why Method was the most frequently chosen product in the aware condition. Each of the products were rated similarly on all attributes; thus, participants could not use product performance as a differentiating factor. Instead, they may have relied on a perceived superior aesthetic design. Using the product reassured participants of its functional performance, while also having the benefits of pleasant aesthetic design and environmental attributes.

Participants in the aware condition were willing to pay significantly more for five out of six of the products than participants in the blind condition. This further hints at the importance of product aesthetics. Between the two conditions, the only difference was the bottle in which the product was presented. In the blind condition, the bottle was plain white. In the aware condition, the products were presented in their original, branded packaging. This could suggest that either product appearance or brand information may influence how much the participants were willing to pay for each product, moreso than whether the product is green or not. However, participants in the aware condition were also willing to pay significantly more for Method than for three of the conventional products; Cif, Flash and Mr Muscle. As green products are often priced higher than conventional products (Lin and Chang, 2012), this provides reassurance that green products could still sell successfully despite their higher price. However, it could also suggest that participants were likely aware that green products cost more than conventional products, and reflected this in their answers. Self-identified green consumers indicated a willingness to pay significantly more for both Ecover and Method; for them, the environmental attributes of the product may be enough to warrant the higher price.

Research by Lin and Chang (2012) would suggest that when individuals know a product is green, they would use more of it due to perceptions of poor perceived product efficacy. This has previously been proven for hand sanitizer and mouthwash. The fact that there were no significant differences across conditions in how much product was used to clean is reassuring. If consumers who use green cleaning products use similar amounts to those who use conventional products, this ensures that any environmental benefits of the product aren’t cancelled out through excessive usage.

4.6.2.2. Consumer perceptions of chemicals in products

For participants who knowingly selected a green product as their reward, a number of them made comments about the ‘chemical’ nature of conventional products. While far beyond the scope of the current research to explore consumer perceptions of chemicals, this warranted brief discussion. A number of participants in the aware condition made reference to the fact that the green products did not ‘smell as chemically’ as the conventional products. In the blind condition, one participant misidentified Dettol as a green product, believing this due to its absence of odour. This may suggest a worrying misconception held by individuals that green products do not contain ‘chemicals’; this is something which future research must address. Many green products – including the two in the study – are advertised as ‘natural’, ‘plant-based’ and ‘non-toxic’. This may feed into the perception that green products are safer than conventional products. Furthermore, every participant who mentioned the ‘chemical’ nature of conventional products did so in relation to scent. This could suggest that individuals use scent as a heuristic for deciding whether a product contains harmful chemicals or not. Method – one of the products commonly cited as less “chemically” smelling - was scented with lavender. As the product was advertised as plant-based, a floral scent could reinforce the schema that green products are natural, and thus do not contain ‘chemicals’.

4.6.2.3. Research limitations

There are a number of limitations of the present research. Firstly, the small sample size cannot be ignored, especially when considering subsections of participants within the results. A larger sample size was hoped for, however participant recruitment proved more difficult than initially expected. This is thought to largely be due to the somewhat tedious nature of the study. Attempts were made to address this in a number of ways: removing two soil materials and thus reducing the participant burden, adopting a snowball sample technique and directly reaching out to groups of individuals who may be interested such as cleaning staff and students. In spite of this, recruitment still proved challenging. Results from this research can be viewed as an initial exploration of the sustainability liability in existing products and as a basis for hypotheses for future research. However, any such research must aim to replicate the results within a larger sample size. The research contained in the following chapter thus utilises a less burdensome method in order to achieve a greater sample size.

The research aimed to explore the sustainability liability in a more realistic setting, with a range of products available to consumers to purchase. To a large extent, this was achieved. The research used six widely available products and tested them on stains that the average consumer is likely to encounter. However, while the study may demonstrate consumer preferences upon using existing surface cleaning products, its applicability to real-life purchase scenarios is still limited. Product selection at the end of the study was used as a proxy for product selection in real life. While this study was the first of its kind to attempt to address whether the sustainability liability would impact actual product choice rather than simple purchase intentions, this is still not an accurate depiction of real-life choice. In actual purchase scenarios a consumer would not choose which product to buy after interacting with a number of different products and carefully considering the pros and cons of each.

To expand on this, it is unlikely that consumers will expend great time, effort and energy in selecting which cleaning product to buy (Macdonald and Sharp, 2000; Thøgersen et al., 2012). Consumers are both unable and unmotivated to seek out all of the relevant information, nor can they test out the product in comparison to others prior to purchase (Magnier and Schoormans, 2017; Mai et al., 2019). Instead, consumers are likely to rely on heuristics – the lowest priced product, a trusted brand or the same product they always buy. In this way, the study failed to replicate a realistic purchase environment. Many participants expressed surprise at how well the green cleaning products performed the tasks. It is thus likely that the same individuals would not have selected these products in a shopping environment due to their preconception that the green products would not work as well. It is therefore possible that the effects of the sustainability liability would be amplified in such a situation.

Furthermore, participants did not have to pay for the product that they selected. Whilst this would not have been realistic to expect of participants, it still presents a substantial limitation. 75% of participants indicated that price was an important consideration when selecting a cleaning product. It is well known that green cleaning products cost substantially more than conventional cleaning products. The Method product used in the study retails for £3 per 868ml bottle (£3.63 per litre), whereas the Flash product retails for £1 per 500ml bottle (£2 per litre) (Tesco, 2019). Participants were not provided with any information regarding how much the products in the study actually cost. Thus, while the majority of participants may have selected a green cleaning product as their preferred product, it is unlikely that this would translate to actual purchase behaviour. While willingness to pay for each of the products was measured, it would be naïve to assume that the answers the participants gave would remain true in a non-hypothetical situation.

Additionally, while participants who were aware of which brand they were using indicated that they were willing to pay more for Method than they were for three of the leading conventional brands, it is unsure whether this preference would hold true when faced with an actual purchasing decision where price information is known. A number of participants suggested that they selected Method because it was a new product to them, and they wished to try it out. One explicitly stated that they wished to try it for free. Did the participants actually prefer Method, or did they simply select it due to an opportunity to receive it without actually having to invest in it? Or if the participants did truly prefer Method, would they have preferred it enough to pay a significantly higher price for it than another product that they know works just as well? This is an important consideration, but beyond the scope of the current research.

Thirdly, social desirability cannot be ruled out as an explanation for the results. Steps were taken to minimise this; participants were not informed of the true aim of the study, nor were they informed of the researchers affiliation with the Earth and Environment department. However, it is widely accepted that within society individuals should strive to be environmentally conscious. Thus, in the aware condition, participants may have perceived a pressure to indicate a preference for a green product even if implicitly they preferred a conventional product. This has been demonstrated in previous research, with participant product preferences changing when asked to indicate their own preferences, and the preferences of “the average consumer” (Luchs et al., 2010). Additional research has shown that selection of the green product option significantly reduced once participants did not believe they were being observed (Luchs et al., 2010; Mai et al., 2019). In the present study, the researcher was present at all times during the study due to health and safety regulations. It is thus possible that the increased preference for Method was simply a reflection of the participants wishing to appear environmentally minded.

4.6.2.4. Implications and future research

The present research has a number of implications. Firstly, it was the first of its kind to explore the sustainability liability with real life products. Secondly, the research demonstrates that green cleaning products perform similarly to conventional cleaning products. This indicates that any differences between green and conventional products on functional performance are perceived as opposed to real. This could also suggest that once consumers use green cleaning products, any anxieties they have about the products functional performance will be alleviated. However, getting consumers to initially try green cleaning products must be achieved first. Manufacturers of green cleaning products may wish to consider a marketing campaign by which they work alongside supermarkets to distribute free samples of the products. Results from the research may also suggest that improving the aesthetic design of green products could increase their popularity.

In terms of future research, the results from this study must first be replicated in a larger sample size. The research could also be repeated including a different sample of products; especially green products. Secondly, further research should be carried out that explores the role of aesthetic design in cleaning product preference. A similar study should be repeated that includes asking the participants to rate the products in order of the attractiveness of their appearance. Finally, further research should be conducted to explore consumer perceptions of chemicals in cleaning products. The misperception that green cleaning products do not contain chemicals was only hinted at in this study, yet such a misperception could be dangerous. Research should address whether such a misperception exists on a wider scale, and if so what can be done to alleviate it.

4.7. CONCLUSION

The research demonstrated that in terms of functional performance, green cleaning products perform similarly to their conventional counterparts. This furthers the theoretical concept of the sustainability liability by showing that negative quality perceptions of green products are not present for existing cleaning products (Lin and Chang, 2012; Luchs et al., 2010; Mai et al., 2019). However, it is unclear whether participants held negative quality perceptions before using the product that were alleviated through using the product, or if there were never any negative quality perceptions to start with. This will be explored using a greater sample size in the following chapter. Additionally, participants were willing to pay significantly more for one of the green cleaning products when they knew which product they were using. This suggests that there is still hope for encouraging consumers to switch to green cleaning products.

5: Exploring environmental and human health perceptions of green and conventional multipurpose household cleaning products and their ingredients

5. 1. INTRODUCTION

The previous chapter explored quality perceptions of green products in a small experimental study. The results suggested that contrary to previous research (Lin and Chang, 2012; Luchs et al., 2010; Mai et al., 2019), negative quality perceptions may not be present for existing green cleaning products. However, it remains unclear whether negative quality perceptions never existed for those participants, or whether they originally held negative quality perceptions but these were assuaged through product usage during the study. Thus, this chapter will explore negative quality perceptions of existing green cleaning products using a methodology that does not require participants to interact with the products. Furthermore, section 2.5.2 suggests that individuals may perceive green cleaning products to pose less of a risk to human health than conventional cleaning products. This is also addressed in this chapter. The chapter will begin with a discussion of relevant literature before stating the research hypotheses. The methodology will then be outlined and the results of the study reported. This will be followed by a discussion of the results. The chapter will close with some concluding remarks.

5.1.1. Quality perceptions of green products

Quality perceptions have been discussed in depth so far in this thesis; a brief overview will be provided here to recap but the reader is referred back to Sections 2.2.3, 2.5 and 4.2.1.

At the point of purchase, consumers must make various inferences about a product in terms of the trade offs between the green and conventional option, such as product strength, functionality, convenience and cost (Pancer et al., 2017). Prior to purchase, consumers have to make inferences about these attributes using prior experiences, product packaging and their own perceptions of the product (Luchs et al., 2010). There is a commonly held perception that green products may not be as high in quality as their conventional counterparts, and that selecting the sustainable option will leave the consumer with an inferior product that can not fulfil their functional needs (D'Souza et al., 2007; Luchs and Kumar, 2017). This is amplified for product categories that fulfil a largely functional role, with cleaning products being a prime example. The primary purpose of a cleaning product is to improve the hygiene of consumer's homes and prevent the spread of infectious disease (Goodyear et al., 2015a; Terpstra, 2001). Strength should therefore be an important attribute in a cleaning product; the consumer wants to ensure that any bacteria or germs on their surfaces will be eradicated in order to reduce the likelihood of infection (Aunger et al., 2016). For product categories where the strength of the product is important to the consumer, individuals are likely to perceive the green product as inferior due to the perception that environmental benefits and strength are mutually exclusive in a product (Pancer et al., 2017).

Prior research suggests that when strength is valued in a product, a conventional product will be preferred over the green alternative. Zhu et al. (2012) demonstrate that a hypothetical cleaning product named 'BalanceClean' was judged as more effective than the same product named 'BalanceGreen'. Perceived product efficacy judgements also influenced how much of a product is used; participants using 'BalanceGreen' used 20% more of the product than those who used 'BalanceClean'. In a separate study, participants used significantly more of a mouthwash framed as eco-friendly than they did for the same mouthwash when it was framed as a conventional product (Lin and Chang, 2012). This suggests that consumers believe the green product to be less effective than its conventional counterpart and thus used more to counteract its inferior quality. Professional cleaning staff reported having to work harder and experienced greater musculoskeletal pain when using green cleaning products than conventional products, thus suggesting the inferior strength of green cleaning products (Simcox et al., 2012). Thus, a product being marketed as green has numerous implications for the consumer beyond the products environmental qualities.

5. 1.2. Health perceptions of green products

While a green product may be perceived to be less effective in terms of its quality, consumers may also perceive green products to be less harmful to health than conventional products. Consumers perceive green products to be less strong than conventional counterparts; it thus follows that they will therefore be perceived to be less harmful to health as well as the environment. As previously discussed, individuals associate environmental qualities with being gentle, protective, friendly and safe (Luchs et al., 2010). Many green products are advertised as ‘non-toxic’, ‘natural’, ‘organic’ or ‘plant-based’; such associations lead consumers to view green products as a healthier, safer alternative (Crighton et al., 2013; Klaschka, 2016; Yeomans et al., 2010).

Consumers are positively valanced towards the concept of the natural; natural objects are generally viewed as fundamentally healthier than non-natural objects (Rozin, 2005). Across cultures, individuals intuitively link the concept of natural towards both the environment and health; substances of natural origin are believed to be safer than those of synthetic origin (Bearth et al., 2017; Goodyear et al., 2015a; Rozin et al., 2012). Cigarettes advertised as ‘natural’ and ‘additive-free’ were judged by 40.3% of participants to be less harmful to health than other brands of cigarettes, even in the presence of a label explicitly stating that these cigarettes posed an identical health risk (O’Connor et al., 2017). In terms of cosmetics and skincare, consumers believe that green products are more beneficial to their health and are safer than conventional alternatives. 89% of cosmetic and skincare consumers state that a desire to avoid synthetic chemicals is a critical influence on their purchase decisions (Ecovia, 2007; Kim and Seock, 2009; Liobikienė and Bernatonienė, 2017). Consumers maintain a preference for natural labelled food products even when explicitly stated that the natural and commercially produced products are identical, perceiving the natural food to deliver an increased health value (Rozin et al., 2012). In the context of organic food, Lazzarini et al. (2016) found a positive linear relationship between environmental friendliness and health; the two concepts are clearly related in the minds of the consumer. This suggests both that consumers perceive a close relationship between the environment and health, and that those who care about preserving the environment may also care about preserving their health (Kim and Seock, 2009).

There is little consensus as to whether green cleaning products pose less of a risk to human health than conventional cleaning products. Cleaning products contain preservatives, fragrances, surfactants and solvents; these may be potentially hazardous substances (Klaschka and Rother, 2013; Magnano et al., 2009). There are links between cleaning products and both asthma and contact dermatitis, with occupational cleaners having a higher incidence rate of these conditions than the general population (Le Moual et al., 2012; Ramirez-Martinez et al., 2014; Zock et al., 2007). Chemicals in cleaning products may also be responsible for allergic skin or respiratory reactions (Magnano et al., 2009). Chapter 3 discusses this in more depth.

Little research has addressed the health impacts of green cleaning products. Garza et al (2015) suggest a smaller magnitude of associations for any related health problems for green than conventional cleaning products. Zarogianni et al (2017) state that conventional cleaning products contain the majority of fragrance ingredients – important contact allergens – compared to green products. However, other research suggests that green fragranced products emit hazardous pollutants similar to those of conventional fragranced products; of the most predominant toxic or hazardous ingredients, green and conventional products share 75% (Steinemann, 2016, 2015). Naturally sourced ingredients that may be found in green cleaning products can still act as sensitizers or skin irritants (Klaschka and Rother, 2013).

Despite this lack of supporting evidence, consumers believe green cleaning products to be less hazardous to health than conventional cleaning products. When asked to rate different cleaning products in terms of the danger they pose to health, participants rated green cleaning products as much safer than experts did. Individuals assumed that strong cleaning products must contain much more hazardous, toxic ingredients (Bearth et al., 2017). As the green cleaning products were rated low in terms of perceived risks to health, it could be inferred that participants believed them to be less strong than conventional products. Bearth and Siegrist (2019) find that the risks posed to human health by green cleaning products are frequently under-estimated. This suggests a link between consumer associations of green products, perceived product efficacy and health. However, to the author's knowledge, no study has directly assessed consumer perceptions of both the perceived efficacy and perceived health effects of green cleaning products.

Thus, the above research suggests consumers may use products environmental attributes as a heuristic for judging both perceived product efficacy and perceived harm to health. While green cleaning products may be judged to be low in terms of product efficacy in comparison to conventional cleaning products, they are also perceived to be safer (Bearth et al., 2017; Lin and Chang, 2012; Luchs et al., 2010). This is in spite of research that suggests many of the ingredients in conventional cleaning products can also be found in green cleaning products (Steinemann, 2015). Furthermore, little research exists that assesses if these perceptions hold true at the ingredient level; do consumers perceive less of a risk from the chemicals contained in green cleaning products than those in conventional cleaning products?

5.1.3. Legislation changes and information provision

An in-depth overview of changes to EU legislation is provided in Section 1.1.3 and readers are encouraged to refer back to this section in order to understand what information is now available to consumers as a result of these changes. This newly available information provides the basis for the research in this chapter.

5.1.4. Consumer use and understanding of product label information

While there might be greater information provided to consumers regarding the safety and contents of products, this does not mean that this information will automatically be used in the way that is intended. The underlying assumption of this information is that consumers will read all of the information on the product label, visit the corresponding website with the ingredient list and then carefully consider whether any of the chemicals contained pose a personal risk to either themselves or their families. Following this, they will then choose whether to buy the product and engage in a recommended risk reduction strategy, or move on to look at alternative products and start the process again (Klaschka and Rother, 2013). This is entirely unrealistic; everyday consumption behaviours are more likely to be guided by inferential rules and schema, as opposed to careful, deliberate thought and information processing (Zhu et al., 2012).

Consumers do not come to hazard information as a blank slate – they will be influenced by their prior beliefs, experiences and heuristics, which in turn will influence the attention that they pay to the information and the extent to which they will believe it and comply with the recommendations (Riley, 2014). In terms of green cleaning products, which are assumed to be safe and gentle due to their environmental status, consumers may be misled about the safety of the product. Cleaning products are a familiar product; most individuals will use them on a regular basis (Section 4.5.1.1.). The more familiar an individual is with a product, the lower the risk they will perceive that the product poses (Riley, 2014). This will then influence the time and energy that they are willing to expend on seeking safety or ingredient information.

In an early study of this phenomena, Kovacs et al (1997) find in an observed cleaning product experiment that less than 5% of participants consulted the label on the back of the bottle prior to using the product. More recent research furthers this; Hinks et al (2009) suggest consumers rarely consult product labels. If they do, it is more likely for guidance on how to use the product than for information about the product's safety. Most consumers are likely to only read the first couple of sentences at the top of the product label information, or to just read the directions for use (Riley et al., 2001). Early research suggests that in order to avoid an overload of information, consumers have to select certain subsets of information to focus on – such as price and brand name (Héroux et al., 1988). This is supported by more recent research; Coomber et al. (2015) find that only 25% of participants recalled seeing a logo related to the risks posed by consuming alcohol on the bottles of alcoholic beverages. Furthermore, only 7.3% of the individuals who reported seeing the logo visited the related website. It therefore seems unlikely that an individual will take the time to carefully read the label on a cleaning product and/or visit the corresponding website.

Even if consumers were motivated to carefully read the entirety of the information on the product label, and to visit the website with product ingredient information, this does not mean that they would be able to understand it to a level where they could use it to make an informed choice. Individuals are unlikely to be able to read all of the ingredients that are listed, nor understand any potential environmental or health effects (Klaschka and Rother, 2013). 46% of patients with allergic contact dermatitis to preservatives and/or fragrance ingredients find it difficult or extremely difficult to read ingredient labels on personal care products (Noiesen et al., 2007). These are individuals who will be highly motivated to seek ingredient information in order to avoid known adverse health effects. Long chemical names and overly technical information are difficult for laypeople to understand; interested consumers are expected to have enough knowledge to be able to comprehend highly scientific information (Klaschka, 2010).

Not only do consumers have to exert time and energy to read the product information and visit the ingredient website, but they also have to expend time and energy to acquire knowledge about the chemicals contained in the product and their properties. This is off-putting for consumers and may act as a barrier to accessing safety information; only 25% of personal care product consumers check ingredient lists due to their lack of ease with the technical information (Cervellon and Carey, 2011). For cleaning products – products that are not intended to come into contact with skin – it is possible that consumers will be even less motivated to both seek and comprehend safety and ingredient information. Overly scientific language has been found to decrease the likelihood of consumers reading product labels; laypeople find this information too complicated and difficult to understand (Hinks et al., 2009). It is thus suggested that instead of using the safety information provided, consumers will instead rely on heuristics to assess the risk a product and the chemicals it contains may pose to them. As previously discussed, one such heuristic is likely to be whether the product is advertised as green or not.

5.1.5. Research hypotheses

The main aim of the research was to explore the relationship between a products environmental status, its perceived efficacy and perceived harm to health. A further aim of research was to examine whether knowledge of whether a product was green or not influenced perceptions of the risks posed by the chemicals the product contained. The following hypotheses are proposed:

1. When individuals are aware that a product is marketed as green, they will rate it lower in terms of perceived product efficacy.

2a. When individuals are aware that a product is marketed as green, they will rate it lower in terms of perceived harm to human health from the overall product.

2b. When individuals are aware that a product is marketed as green, they will rate it lower in terms of perceived harm to the environment from the overall product.

3a. When individuals are aware that a product is marketed as green, they will perceive the ingredients the product contains to be less harmful to human health.

3b. When individuals are aware that a product is marketed as green, they will perceive the ingredients the product contains to be less harmful to the environment.

4. This relationship will be moderated by individuals' pro-environmental attitudes.

5.2. Method

5.2.1. Product selection and information

The first stage of the research was to identify products that could be used within the survey. Existing products were desired over the creation of hypotheticals in order to increase the applicability of the results to real life consumer decision-making. Requirements for the products were as follows:

- One needed to be a product that was clearly advertised as a green cleaning product, the other must make no reference to environmental attributes (from here on, this product will be referred to as the conventional product).
- They must have a detailed ingredient list published online (while this is a legislated requirement, not all products comply).
- They must share at least three ingredients in order to be able to repeat and compare questions across both products.

As in Chapters 3 and 4, online supermarket websites were consulted to identify commonly available cleaning products. Ingredient lists were then compared in order to find those that met the requirements. The resulting two products were Flash Clean and Shine Crisp Lemon All Purpose Cleaner spray (conventional), and Ecozone 3in1 Antibacterial Multisurface cleaner (green). Product information was noted, including the advertising materials, safety information, usage and storage information and product ingredients. The three ingredients present in both products selected for comparison were:

- *Limonene*, a common fragrance ingredient on the EU list of 26 known fragrance allergens. It is also registered with ECHA as[3]: very toxic to aquatic life, very toxic to aquatic life with long lasting effects, causes skin irritation and may cause an allergic skin reaction.

[3] Information was correct at the time of research, but is subject to change dependent on further research into ingredient safety.

- *Benzisothiazolinone*, a preservative classified with ECHA as: very toxic to aquatic life, harmful if swallowed, causes serious eye damage, causes skin irritation and may cause allergic skin reaction.
- *Hexyl cinnamal*, a fragrance ingredient on the list of 26 known allergens also classified with ECHA as: very toxic to aquatic life, toxic to aquatic life with long lasting effects and may cause an allergic skin reaction.

5.2.2. Adaptation of information from ECHA

In order to be able to ask meaningful yet understandable questions, information had to be adapted from the ECHA website. There are 21 different human health and 5 environmental hazard categories. To ask questions about each of them would have resulted in an increased participant burden, which is already amplified due to the complexity of the questions. This would further increase the risk of non-completion (Rolstad et al., 2011). Furthermore, many of these categories overlap, with difficult to distinguish classification requirements. For example, there are six different categories related to adverse effects on skin: severe skin burns and eye damage, skin irritation, allergic skin reaction, harmful in contact with skin, toxic in contact with skin and fatal in contact with skin. For the average consumer who is unlikely to be familiar with these categories, discerning the differences between ‘skin irritation’, ‘allergic skin reaction’ or ‘harmful in contact with skin’ would be difficult. Thus, asking separate questions about each of the hazard categories for each product and each of the three chemicals was likely to result in participant discomfort and non-completion. As prior research suggests the main associated effects with cleaning products being respiratory and skin complaints (Le Moual et al., 2012; Magnano et al., 2009; Ramirez-Martinez et al., 2014; Zock et al., 2007), these were focused on, with one question being asked about each. Similarly, two questions were asked about environmental hazards.

5.2.3. Survey design and materials

The survey was created and administered using Qualtrics, employing a 2 (green vs conventional) x 2 (aware vs blind) independent measures design. The research is the first of its kind to explore consumer perceptions of the safety of chemicals in existing products, and as such many of the materials used in the study had to be designed.

Participants were randomly allocated to one of four conditions: green aware, green blind, conventional aware and conventional blind. In the green aware condition, participants were shown a photo of the product (Appendix 6), followed by information about the product taken from the product website. This information emphasised the environmental attributes of the product. They were also provided with safety and usage directions and the product ingredient list, again taken verbatim from the product website. Each question referred to the product by brand name, which included the word ‘Eco’. The conventional aware condition was similar; participants were shown a photo of the product (Appendix 7) followed by information taken from the product website, safety and usage directions and the ingredient list. As it was a conventional product, there was no reference to environmental attributes. In the green blind condition, participants did not see a photo of the product, simply the product information, safety and usage directions and the ingredient list. Any reference to the product being green in this information was omitted (Appendix 8). The conventional blind condition was similar; no photo was shown of the product and any information revealing the brand name was removed (Appendix 9). Beyond changes to the actual product, participants in each condition received the same questionnaires and were asked to answer the same questions.

Participants in all conditions were instructed to carefully read the information before moving onto a set of questions. In the green and blind aware condition, participants were asked a manipulation check question as to whether the product was marketed as environmentally friendly or not. This was done using a simple yes/no question.

All participants were then asked to rate the following on Likert scales of 1-7:

- How effective they thought the product would be at cleaning in the home

- How harmful they thought the product would be if it came into contact with skin
- How harmful they thought the product would be if they breathed it in
- How harmful they thought it would be to the overall environment
- How harmful they thought it would be to aquatic life.

Following this, they were then told that the product contained limonene. They were provided with a table explaining the functions of ingredients in cleaning products (Appendix 10), and asked to indicate what function they believed limonene performed in the product. Here they had to select their answer from a given range of options, identical to those in the table that explained the function of ingredients. They were then asked to rate on Likert scales of 1-7 how harmful they believed limonene would be if it came into contact with skin, how harmful they believed limonene would be if they breathed it in, how harmful they thought limonene would be to the overall environment, and how harmful they thought limonene would be to aquatic life. This was repeated for bensizothiazolinone and hexyl cinnamal.

Participants were then asked to indicate on a 1-7 Likert scale how useful they had found the product information and ingredient list in answering the questions, and how familiar they were with the ingredients in the survey. They were then asked some demographic information, including age, gender and education, as well as the composition of their household and how often they cleaned/bought cleaning products. They were then asked to select the 3 most important qualities to them in a cleaning product from the following list: price, quantity, brand, scent, colour, strength, whether the product was on offer, whether they had used the product before, whether the product was advertised as eco-friendly, and whether the product was advertised as suitable for sensitive skin. They were also asked what cleaning products they had bought or used in the last month using a multiple choice format listing all popular UK brands of cleaning products, along with an ‘other’ option. They were then asked if they had any scientific background or training, and if so asked to clarify what this background was. Finally they were asked to complete the New Environmental Paradigm (Dunlap and Van Liere, 1978). This was included in order to control for environmental attitudes in case this influenced their rating of the green product. The entire survey (minus product information, which differed across conditions) can be found in Appendix 11.

5.2.4. Recruitment and participants

Participants were recruited using Amazon Mechanical Turk. Amazon Mechanical Turk (MTurk) is frequently used in online social science research, with similar reliability and greater diversity than traditional methods (Bentley et al., 2017; Buhrmester et al., 2016; Casler et al., 2013; Holden et al., 2013; Mason and Suri, 2012). ‘Workers’ (participants) on MTurk sign up to complete ‘HITs’ (tasks). Individuals or organisations therefore use MTurk to hire individuals to complete a range of computer-based tasks (Levay et al., 2016). While not exclusively used for research purposes, MTurk is frequently used as an alternative to market research panels. In the case of this research, the survey was the ‘task’ that was distributed to workers. Upon completion of the tasks, the requesting individual or organisation can then review the responses and pay the workers for successful completion of the task. In this way, MTurk functions as a way to distribute paid online surveys. MTurk has been found to be well suited for experimental work such as that of the current research (Levay et al., 2016). MTurk workers are largely American, with around 80% of the workforce pool being based in North American (Buhrmester et al., 2011; Sheehan et al., 2018). However, MTurk does not provide detailed geographic information per sample, so it is not possible to specify the country of residence of the participants.

Participants were invited to take part in an online survey about chemicals in cleaning products, for the reward of $1. Paid online surveys are often used to explore consumer perceptions of chemicals (Saleh et al., 2019). As is recommended with MTurk, only participants with an approval rating of >95% were eligible to complete the survey (Peer et al., 2014). This means that the survey was only available to be completed by workers who had proven themselves to be reliable through the successful completion previous tasks. The survey was initially piloted with 40 participants to ensure that there were no issues. Upon successful completion of the pilot, 400 participants in total completed the survey. 5 exited the survey before fully completing it with a response time of <1 minute and were thus their data was excluded, leaving a final sample of 395. Of this final sample, response times were examined and no extreme values were identified. 96 participants were allocated to the conventional blind condition, 108 to the green blind. 88 participants were allocated to the conventional aware condition, 103 to the green aware. Recruitment took place in May 2018.

5.3. Results

5.3.1. Sample information

Figures 13 and 14 display the age and education background of the sample. 63.5% of the sample was male. 84.1% of participants lived in households of 4 people or fewer. 24.1% of participants indicated that they had some form of scientific background.

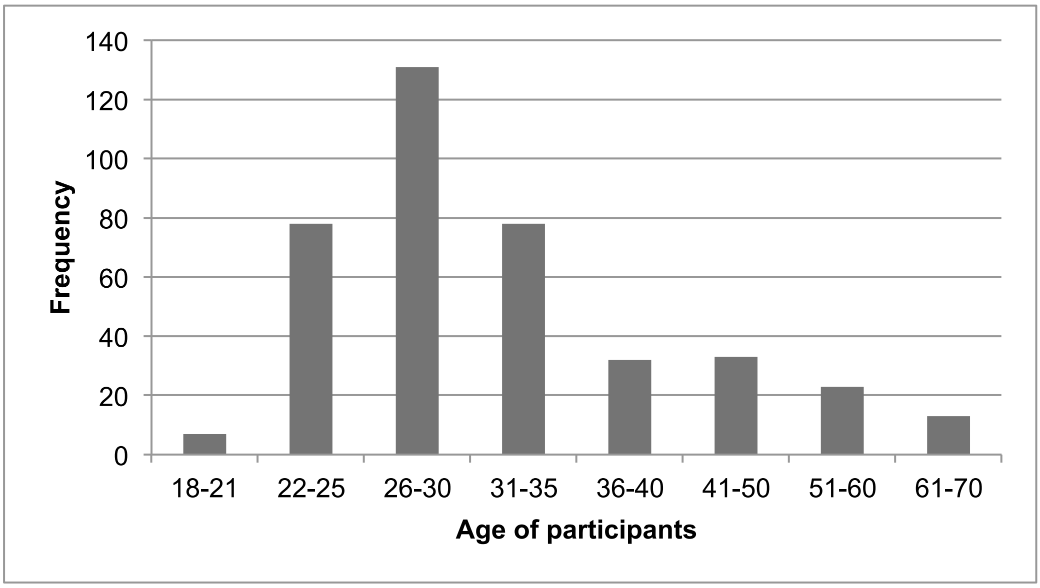

Figure 13: Sample age

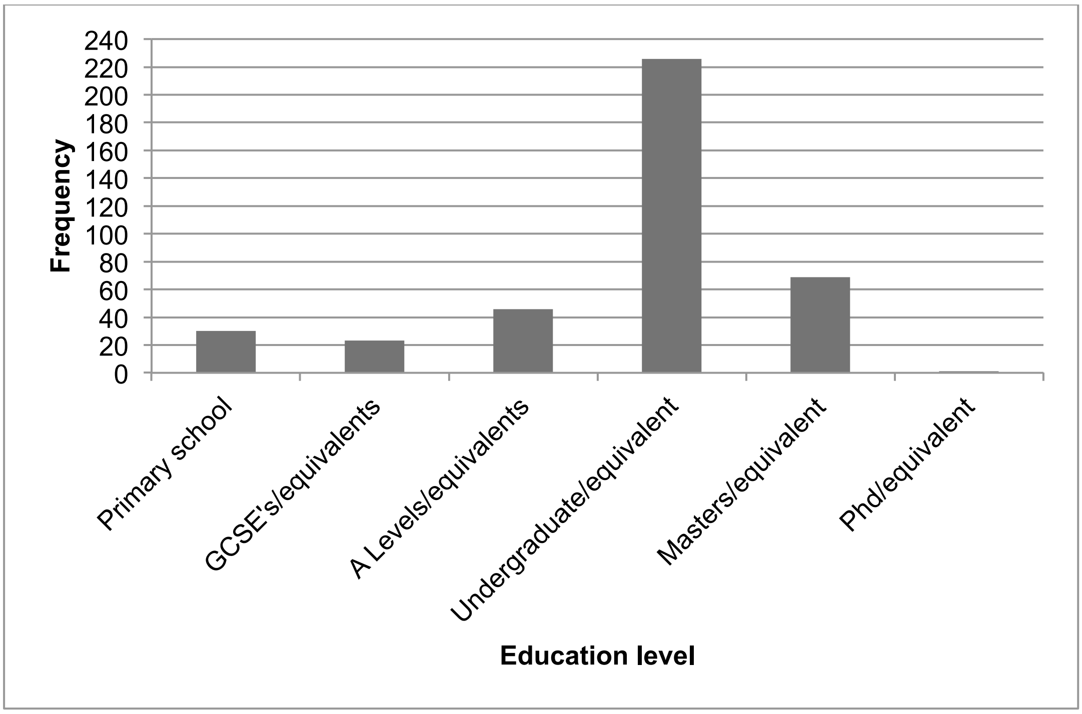

Figure 14: Sample education

5.3.1.1. Cleaning behaviour

87.8% of participants were the main person responsible for purchasing cleaning products in their household. 83.8% were the main person responsible for cleaning in their household. The majority of participants (40.5%) purchased household cleaning products on a monthly basis. The most common frequency for using household cleaning products was weekly, with 33.5% of participants selecting this option. However, daily (24.4%) and every other day (19%) were also common.

5.3.1.2. Important qualities in cleaning products

Participants were asked to indicate the three most important qualities to them in a cleaning product. The results are shown in Figure 15.

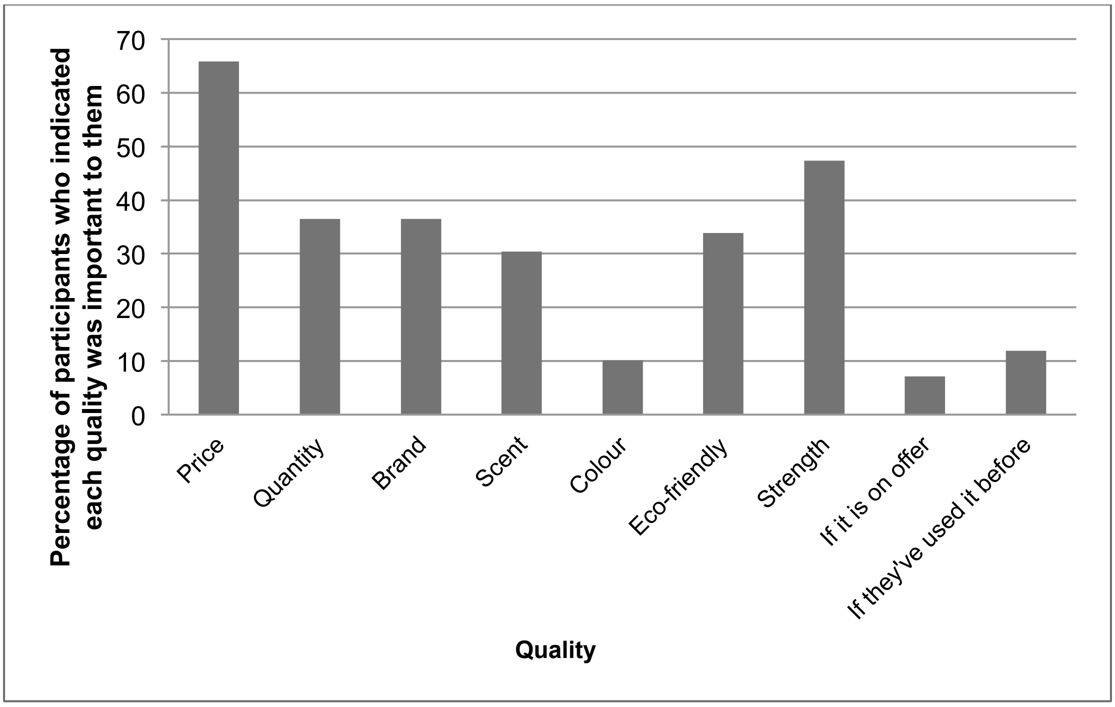

Figure 15: Important qualities in a cleaning product

5.3.1.3. Identification of ingredient function

Participants were asked to indicate what function each of the three ingredients performed in a product. Table 10 shows the results for Limonene. 47.1% of participants correctly identified that Limonene is a fragrance ingredient.

Table 10: Participant identification of ingredient function: Limonene

Function	Frequency
Builder	24
Colourant	31
Disinfectant	46
Fragrance	186
Preservative	40
Solvent	35
Surfactant	31

Table 11 shows the results for Benzisothiazolinone. 21% of participants correctly identified that Benzisothiazolinone is a preservative.

Table 11: Participant identification of ingredient function: Benzisothiazolinone

Function	Frequency
Builder	34
Colourant	19
Disinfectant	123
Fragrance	25
Preservative	83
Solvent	71
Surfactant	39

Table 12 shows the results for Hexyl Cinnamal. 34.9% of participants correctly identified that Hexyl Cinnamal was a fragrance.

Table 12: Participant identification of ingredient function: Hexyl cinnamal

Function	Frequency
Builder	25
Colourant	15
Disinfectant	89
Fragrance	138
Preservative	23
Solvent	61
Surfactant	41

5.3.2. Manipulation checks

In the green and conventional aware conditions, participants were asked to indicate whether they believed the product was marketed as environmentally friendly or not. In the conventional aware condition, 38.6% of participants indicated that the product was marketed as environmentally friendly. Thus, only 61.4% of participants passed the manipulation check in the conventional aware condition. In the green aware condition, 24.3% of participants indicated that the product was not marketed as environmentally friendly. 75.7% of participants thus passed the manipulation check in the green aware condition. This is a much higher manipulation check failure rate than would be expected, and will be looked at further.

5.3.3. Hypothesis 1: Perceived product efficacy

5.3.3.1. Descriptive statistics

The mean and standard deviation were calculated for ratings of perceived product efficacy. These are shown in Table 13.

Table 13: Means and standard deviations for product effectiveness by condition

Product type	Mean rating of effectiveness	Standard deviation
Conventional aware	5.34	1.076
Green aware	5.09	1.189
Conventional blind	5.25	1.298
Green blind	5.43	1.334

5.3.3.2. Differences between conditions

The data were analysed using a 2(type of product) x 2(experimental condition) independent measures ANOVA. When referring to experimental condition, this refers to the blind or aware conditions. When referring to type of product, this refers to whether the product was green or conventional. Total score on the NEP was included as a moderating variable, in order to allow for the effects of environmental attitudes. There was no significant effect of type of product on perceived product efficacy $F(1, 385)=.056$, $p=.813$. There was no significant effect of experimental condition on perceived product efficacy $F(1,385)=1.178$, $p=.279$. There were also no significant interaction effects. Thus, Hypothesis 1 is unsupported. Hypothesis 4 is also unsupported for overall product efficacy; as there is no relationship between type of product and experimental condition, environmental attitudes cannot moderate it.

5.3.4. Hypotheses 2: Perceived product harm to human health and the environment

The data were analysed using a 2 x 2 independent measures ANOVA, with environmental attitudes as a moderating variable. For presentation purposes, environmental attitudes have been dichotomized using scores above and below the median as criteria. Scores on the NEP below the median suggest an individual low in environmental attitudes, scores on the NEP above the median suggest an individual high in environmental attitudes.

5.3.4.1.Hypothesis 2a: Perceived overall product harm to human health

- There was a significant main effect of experimental condition on perceived harm to skin F(1, 382)=10.934, p=<.01.
- There was no significant main effect of type of product on perceived harm to skin F(1,382)=.730, p=.393.
- There was a significant main effect of environmental attitudes on perceived harm to skin F(1,21.577), p=<.01.
- There was a significant interaction effect between experimental condition and environmental attitudes on perceived harm to skin F(1, 382)=9.188, p=<.01. The results from this are shown in Figure 16. Those with lower environmental attitudes perceived the product to be less harmful in the aware condition than in the blind condition. Error bars on the figure refer to the standard error.

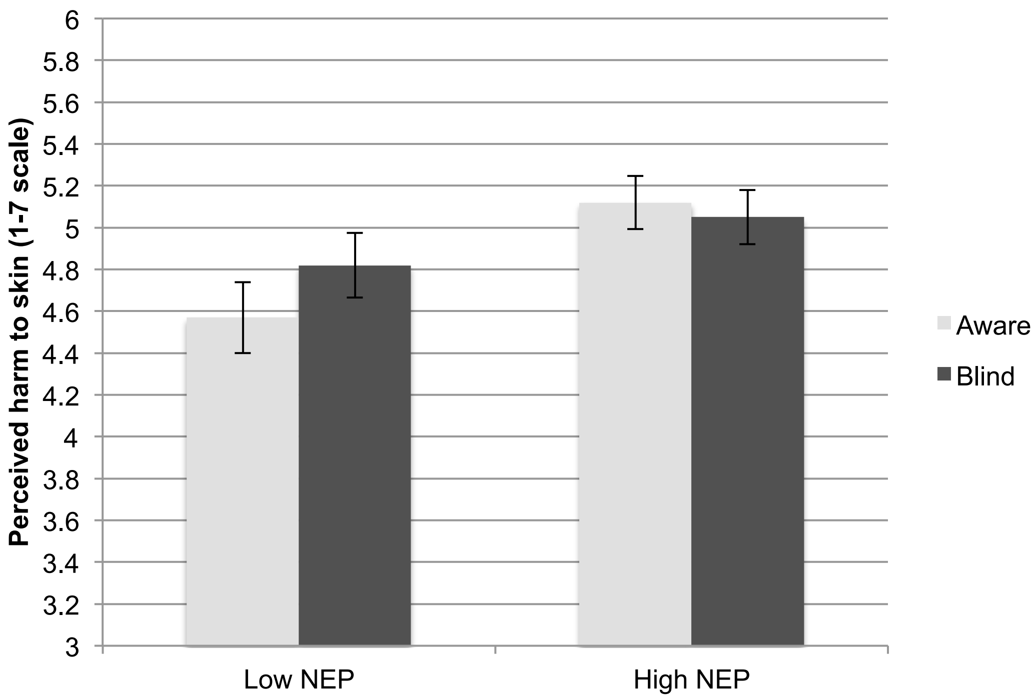

Figure 16: The interaction between environmental attitudes and experimental condition on perceived product harm to skin

The same pattern of results is visible for perceived product harm when inhaled.

- There was no significant main effect of type of product on harm when inhaled F(1, 383)=1.686, p=.195.
- There was a significant main effect of experimental condition on perceived product harm when inhaled F(1,383)=6.541, p=<.01.
- There was a significant main effect of environmental attitudes on perceived product harm when inhaled F(1,383)=8.144, p=<.01.
- There was also a significant interaction effect of experimental condition and environmental attitudes F(1,383)=6.270, p=<.05, the results of this being shown in Figure 17. In the aware condition, participants with higher environmental attitudes perceived the product to be significantly more harmful when inhaled than those with lower environmental attitudes. Error bars on the figure refer to the standard error.

As there were no significant main effects of product type or significant interactions between product type and experimental condition, Hypothesis 2a remains unsupported. Hypothesis 4 is also unsupported for overall product harm to health; as there is no relationship between type of product and experimental condition, environmental attitudes cannot moderate it.

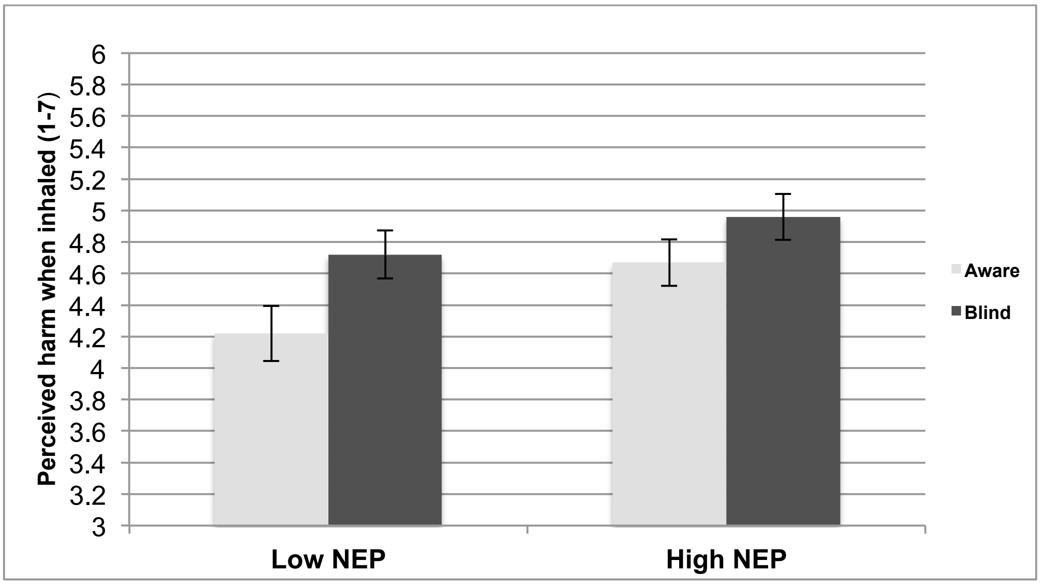

Figure 17: The interaction between environmental attitudes and experimental condition on perceived harm when inhaled

5.3.4.2. Hypothesis 2b: Perceived overall product harm to the environment and aquatic life

- There was a significant main effect of experimental condition on perceived overall product harm to the environment $F(1,384)=12.024$, $p=<.001$.
- There was no significant main effect of type of product on perceived overall product harm to the environment $F(1,384)=.391$, $p=.532$.
- There was no significant main effect of environmental attitudes on perceived product harm to the environment $F(1,384)=3.234$, $p=.073$.
- There was a significant interaction between experimental condition and environmental attitudes $F(1,384)=10.058$, $p=<.01$. This is shown in Figure 18. In the aware condition, participants with higher environmental attitudes perceived the product to be significantly more harmful to the environment than participants with lower environmental attitudes. Participants with low environmental attitudes in the aware condition perceived the product to be significantly less harmful to the environment than participants with low environmental attitudes in the blind condition. Error bars on the figure refer to the standard error.

This pattern of results is repeated for perceived overall product harm to aquatic life.

- There was a significant main effect of experimental condition on perceived product harm to aquatic life $F(1,386)=11.818$, $p=<.001$
- There was a significant interaction effect between experimental condition and environmental attitudes (Figure 19) $F(1, 386)=10.165$, $p=<.01$. Error bars on the figure refer to the standard error.
- There are no significant main effects for type of product, nor any further interactions. Thus, Hypothesis 2b is unsupported. Hypothesis 4 is also unsupported for overall product efficacy; as there is no relationship between type of product and experimental condition, environmental attitudes cannot moderate it.

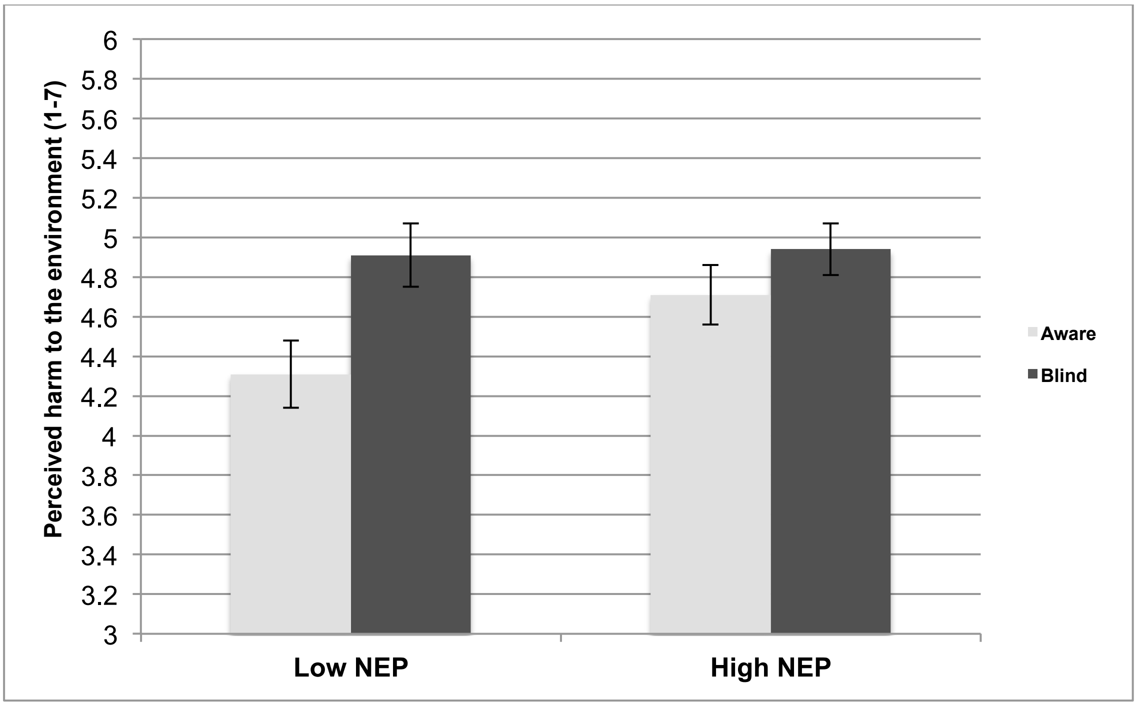

Figure 18: The interaction between experimental condition and environmental attitudes for perceived product harm to the environment

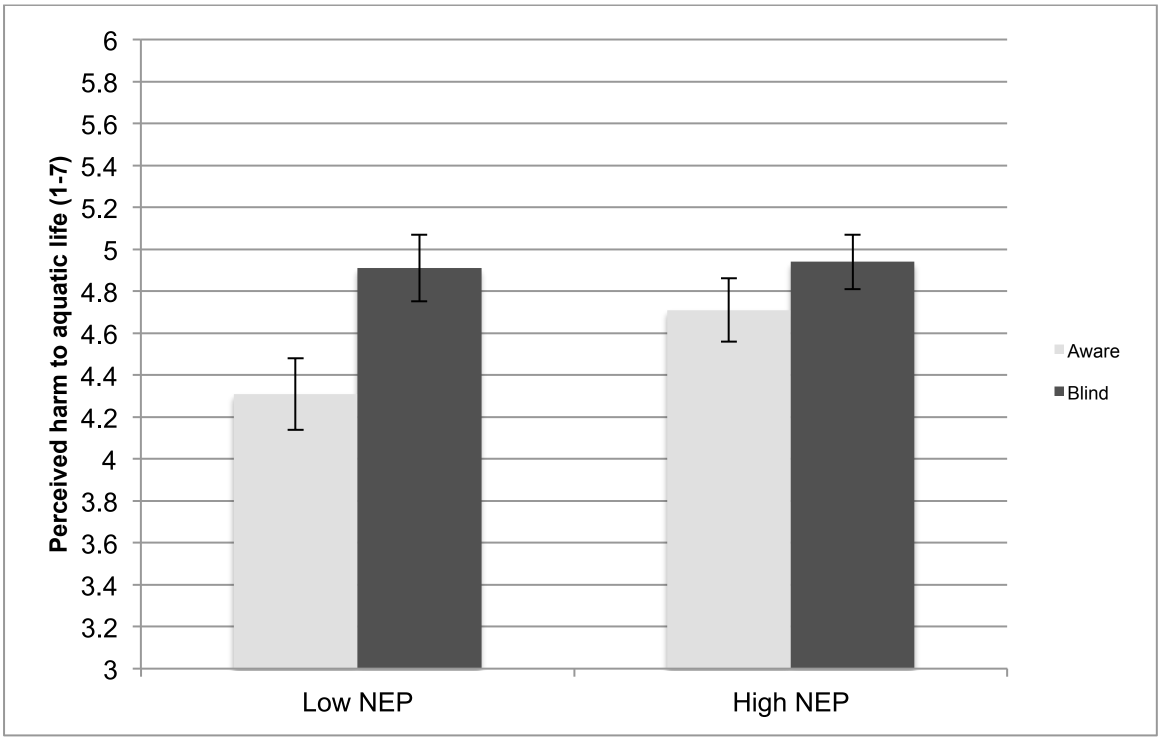

Figure 19: The interaction between experimental condition and environmental attitudes for perceived product harm to aquatic life

5.3.5. Hypothesis 3a: Perceived ingredient harm to human health

The data were analysed using a 2 x 2 independent measures ANOVA, with environmental attitudes as a moderating variable. For presentation purposes, environmental attitudes have been dichotomized using scores above and below the median as criteria. Scores on the NEP below the median suggest an individual low in environmental attitudes, scores on the NEP above the median suggest an individual high in environmental attitudes.

5.3.5.1. Perceived ingredient harm to human health – limonene

- There was no significant main effect of type of product on limonene's perceived harm to skin $F(1,386)=.203$, $p=.652$.
- There was no significant main effect of experimental condition on limonene's perceived harm to skin $F(1,386)=1.069$, $p=.302$.
- There were no significant interaction effects between type of product and experimental condition on limonene's perceived harm to skin $F(1,386)=.546$, $p=.656$.
- There was a significant main effect of environmental attitudes on limonene's perceived harm to skin $F(1,386)=27.896$, $p=<.001$. There were no significant interactions between any of the variables.
- There was no significant main effect of type of product on limonene's perceived harm when inhaled $F(1,386)=.015$, $p=.903$.
- There was no significant main effect of experimental condition on limonene's perceived harm when inhaled $F(1,386)=.493$, $p=.483$.
- There were no significant interaction effects between type of product and experimental condition on perceived harm when inhaled $F(1,386)=.270$, $p=.604$.
- There was a significant main effect of environmental attitudes on perceived harm when inhaled $F(1,386)=16.088$, $p=<.001$. There were no significant interactions between any of the variables.

The above results suggest that for the ingredient limonene, Hypothesis 3a is unsupported. Hypothesis 4 is also unsupported for limonene's perceived harm to human health; as there is no relationship between type of product and experimental condition, environmental attitudes cannot moderate it.

5.3.5.2. Perceived harm to human health – benzisothiazolinone

- There was a significant main effect of experimental condition on benzisothiazolinone's perceived harm to skin $F(1,381)=5.196$, $p=<.05$.
- There was no significant main effect of type of product on benzisothiazolinone's perceived harm to skin $F(1,381)=.952$, $p=<.05$.
- There was a significant interaction between experimental condition and environmental attitudes on benzisothiazolinone's perceived harm to skin $F(1,381)=5.141$, $p=<.05$. This is displayed in Figure 20. In the aware condition, participants with higher environmental attitudes perceived benzisothiazolinone to be more harmful to skin than those with lower environmental attitudes. Error bars on the figure refer to the standard error.

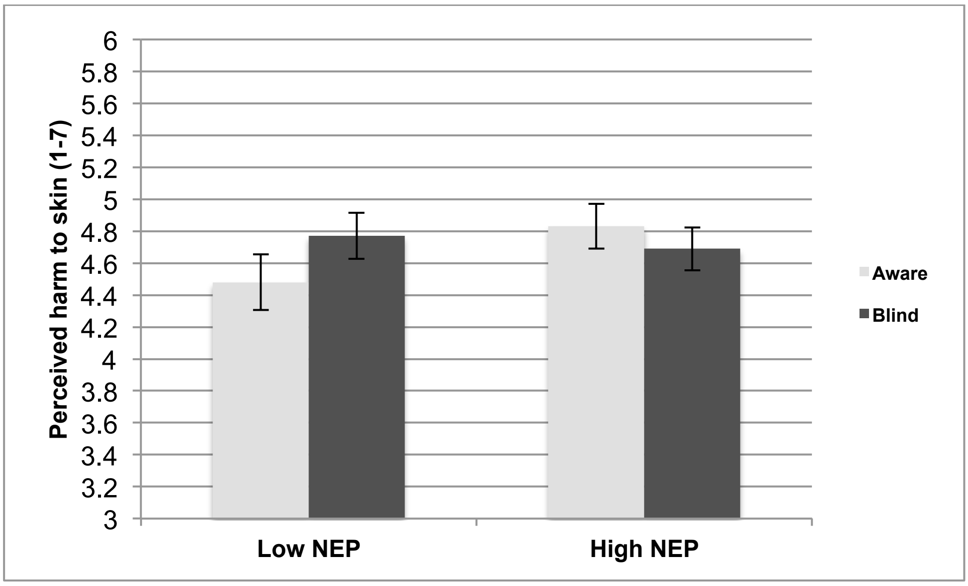

Figure 20: The interaction between experimental condition and environmental attitudes on benzisothiazolinone's perceived harm to skin

- There was no significant main effect of type of product on benzisothiazolinone's perceived harm when inhaled $F(1,383)=.207$, $p=.649$.

- There was no significant main effect of experimental condition on benzisothiazolinone's perceived harm when inhaled F(1,383)=.336, p=.562.
- There was a significant main effect of environmental attitudes on benzisothiazolinone's perceived harm when inhaled F(1,383)=5.076, p=<.05. There were no significant interactions.

The above results suggest that for benzisothiazolinone, Hypothesis 3a is unsupported. Hypothesis 4 is also unsupported for benzisothiazolinone's perceived harm to human health; as there is no relationship between type of product and experimental condition, environmental attitudes cannot moderate it.

5.3.5.3. Perceived harm to health – hexyl cinnamal

- There was no significant main effect of type of product on hexyl cinnamal's perceived harm to skin F(1,382)=1.048, p=.307.
- There was no significant main effect of experimental condition on hexyl cinnamal's perceived harm to skin F(1,382)=3.579, p=.059.
- There was no significant main effect of environmental attitudes on hexyl cinnamal's perceived harm to skin F(1,382)=2.724, p=.100.
- There were no significant interaction effects.
- There was no significant main effect of type of product on hexyl cinnamal's perceived harm when inhaled F(1,385)=.024, p=.478.
- There was no significant main effect of experimental condition on hexyl cinnamal's perceived harm when inhaled F(1,385)=.504, p=.478.
- There was a significant main effect of environmental attitudes on hexyl cinnamal's perceived harm when inhaled F(1,385)=4.493, p=<.05.
- There were no significant interaction effects.

The above results suggest that for the ingredient hexyl cinnamal, Hypothesis 3a remains unsupported. Hypothesis 4 is also unsupported for hexyl cinnamal's perceived harm to human health; as there is no relationship between type of product and experimental condition, environmental attitudes cannot moderate it. As a result of sections 5.3.5.1, 5.3.5.2 and 5.3.5.3, Hypothesis 3a is to be rejected.

5.3.6. Hypothesis 3b: Perceived ingredient harm to the environment

The data were analysed using a 2 x 2 independent measures ANOVA, with environmental attitudes as a moderating variable. For presentation purposes, environmental attitudes have been dichotomized using scores above and below the median as criteria. Scores on the NEP below the median suggest an individual low in environmental attitudes, scores on the NEP above the median suggest an individual high in environmental attitudes.

5.3.6.1. Perceived ingredient harm to the environment – limonene

- There was no significant main effect of type of product on limonene's perceived harm to the environment $F(1,385)=.661$, $p=.417$.
- There was no significant main effect of experimental condition on limonene's perceived harm to the environment $F(1,385)=1.775$, $p=.184$.
- There were no significant interaction effects between the type of product and experimental condition on limonene's perceived harm to the environment $F(1,385)=.075$, $p=.784$.
- There was a significant main effect of environmental attitudes on limonene's perceived harm to the environment $F(1,385)=10.917$, $p=<.001$.
- There were no significant interactions.
- There was no significant main effect of type of product on limonene's perceived harm to aquatic life $F(1,386)=.018$, $p=.893$.
- There was a significant main effect of experimental condition on limonene's perceived harm to aquatic life $F(1,386)=4.068$, $p=<.05$.
- There was a significant main effect of environmental attitudes on limonene's perceived harm to aquatic life $F(1,386)=6.004$, $p=<.05$.
- There was a significant interaction between experimental condition and environmental attitudes on limonene's perceived harm to aquatic life $F(1,386)=4.720$, $p=<.05$. This is displayed in Figure 21. In the aware condition, participants with higher environmental attitudes perceived limonene to be more harmful to aquatic life than those with lower

environmental attitudes. Participants in the aware condition with higher environmental attitudes perceived limonene to be more harmful to aquatic life than those with high or low environmental attitudes in the blind condition. Error bars on the figure refer to the standard error.

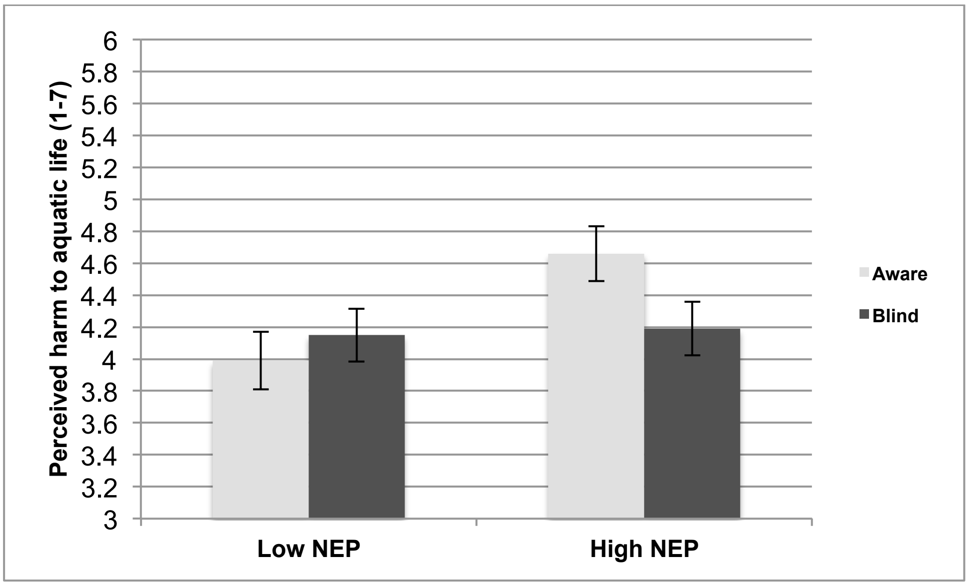

Figure 21: The interaction between experimental condition and environmental attitudes on limonene's perceived harm to aquatic life

Thus, the above results suggest that for limonene, Hypothesis 3b is unsupported. Hypothesis 4 is also unsupported for limonene's perceived harm to the environment; as there is no relationship between type of product and experimental condition, environmental attitudes cannot moderate it.

5.3.6.2. Perceived ingredient harm to the environment – benzisothiazolinone

- There was no significant main effect of type of product on benzisothiazolinone's perceived harm to the environment $F(1,384)=.356$, $p=.551$.
- There was a significant main effect of experimental condition on benzisothiazolinone's perceived harm to the environment $F(1,384)=4.969$, $p=<.05$.
- There was no significant interaction between type of product and experimental condition on perceived harm to the environment $F(1,384)=.770$, $p=.381$.

- There was no significant main effect of environmental attitudes on benzisothiazolinone's perceived harm to the environment F(1,384)=2.918, p=<0.88.
- There was a significant interaction between experimental condition and environmental attitudes F(1,384)=4.466, p=<.05. This is displayed in Figure 22. Participants with high environmental attitudes in both the blind and aware conditions did not differ in terms of benzisothiazolinone's perceived harm to the environment, however they did perceive benzisothiazolinone to be more harmful to the environment than those with low environmental attitudes in the aware condition. Error bars on the figure refer to the standard error.

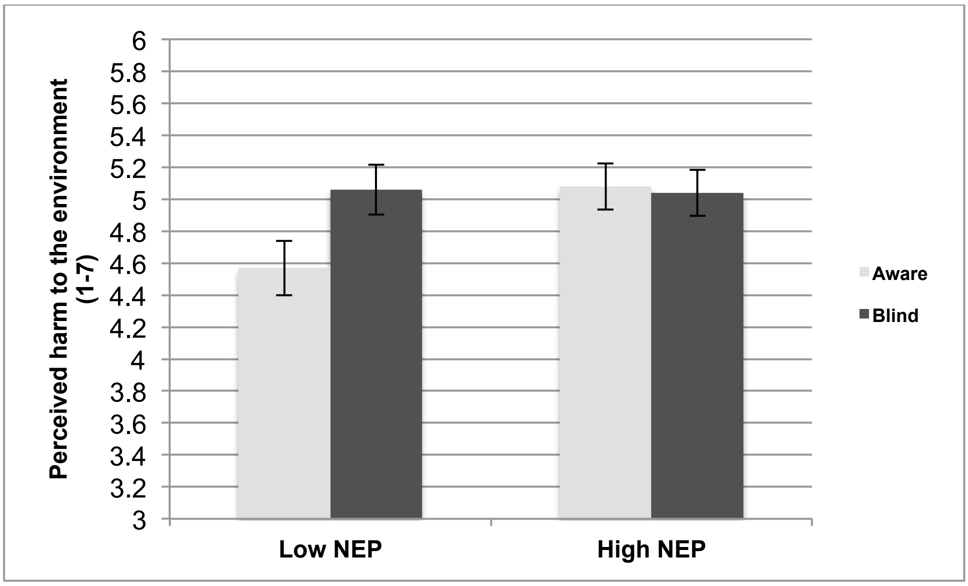

Figure 22: The interaction between experimental condition and environmental attitudes on benzisothiazolinone's perceived harm to the environment

- There was a significant main effect of experimental condition on benzisothiazolinone's perceived harm to aquatic life F(1,386)=4.285, p=<.05.
- There was no significant main effect of product type on benzisothiazolinone's perceived harm to aquatic life F(1,386)=.022, p=.883.
- There was no significant main effect of environmental attitudes on benzisothiazolinone's perceived harm to aquatic life F(1,386)=.139, p=.710.

- There was a significant interaction between experimental condition and environmental attitudes on benzisothiazolinone's perceived harm to aquatic life $F(1,386)=4.153$, $p=<0.5$. This is shown in Figure 23. Participants with higher environmental attitudes in the aware condition perceived benzisothiazolinone to be more harmful to aquatic life than participants in the aware condition with lower environmental attitudes. Error bars on the figure refer to the standard error.

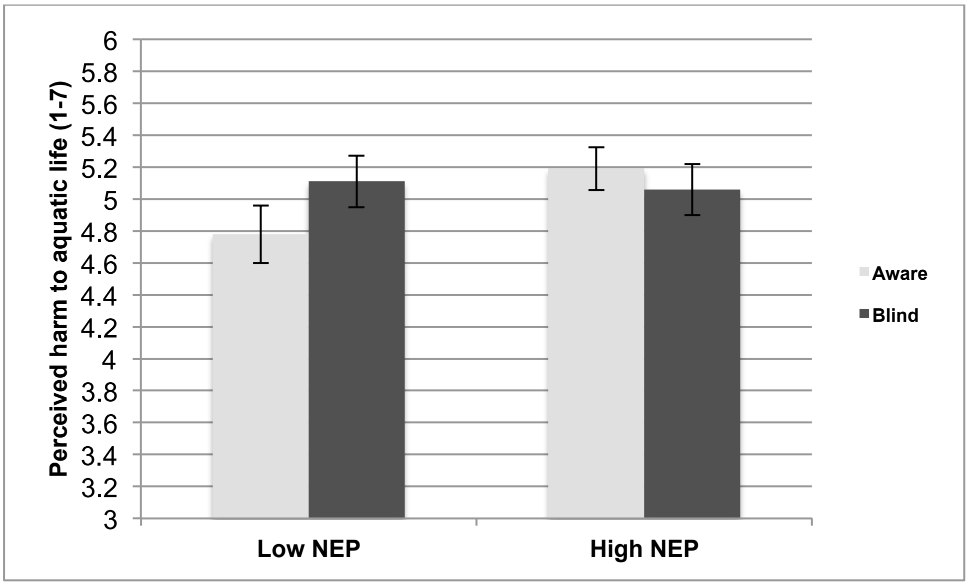

Figure 23: The interaction between experimental condition and environmental attitudes on benzisothiazolinone's perceived harm to aquatic life

Thus, the above results suggest that for benzisothiazolinone, Hypothesis 3b is unsupported. Hypothesis 4 is also unsupported for benzisothiazolinone's perceived harm to the environment; as there is no relationship between type of product and experimental condition, environmental attitudes cannot moderate it.

5.3.6.3. Perceived ingredient harm to the environment – hexyl cinnamal

- There was no significant main effect of type of product on hexyl cinnamal's perceived harm to the environment $F(1,386)=.304$, $p=.582$.
- There was no significant main effect of experimental condition on hexyl cinnamal's perceived harm to the environment $F(1,386)=3.132$, $p=.078$.

- There was a significant main effect of environmental attitudes on hexyl cinnamal's perceived harm to the environment $F(1,382)=5.732$, $p=<.05$.
- There were no significant interactions.
- There was no significant main effect of type of product on hexyl cinnamal's perceived harm to aquatic life $F(1,385)=.443$, $p=.506$.
- There was a significant main effect of experimental condition on hexyl cinnamal's perceived harm to aquatic life $F(1,385)=4.810$, $p=<.05$.
- There was no significant main effect of environmental attitudes on hexyl cinnamal's perceived harm to aquatic life $F(1,385)=.735$, $p=.392$.
- There was a significant interaction between experimental condition and environmental attitudes on hexyl cinnamal's perceived harm to aquatic life $F(1,385)=4.658$, $p=<.05$. This is displayed in Figure 24. Participants with higher environmental attitudes in the aware condition perceived hexyl cinnamal to be more harmful to the environment than participants in the aware condition with lower environmental attitudes. Error bars on the figure refer to the standard error.

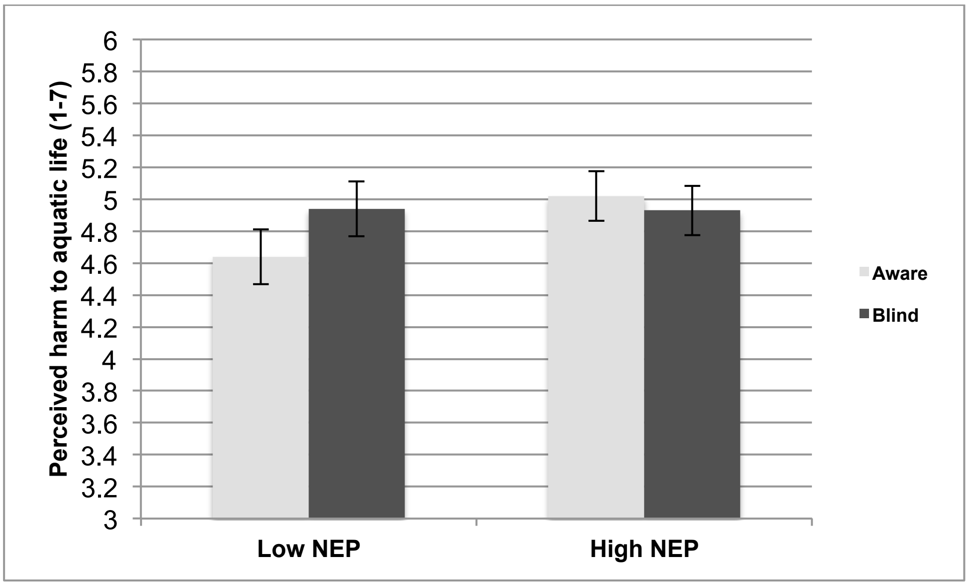

Figure 24: The interaction between experimental condition and environmental attitudes on hexyl cinnamal's perceived harm to aquatic life

Thus, the above results suggest that for hexyl cinnamal, Hypothesis 3b is unsupported. Hypothesis 4 is also unsupported for hexyl cinnamal's perceived harm to the environment; as there is no relationship between type of product and experimental condition, environmental attitudes cannot moderate it. Thus, for all ingredients, Hypothesis 3b is unsupported.

5.3.7. Comparisons between those who passed the manipulation check and those who did not

Due to the relatively large proportion of participants who did not correctly identify the type of product, comparisons were made between those who passed the manipulation check and those who did not. It is unsurprising for there to be no main effects for type of product when up to a third of participants can not correctly identify the type of product. An additional variable was created to indicate whether participants passed the manipulation check or not. If participants were allocated to the green experimental condition and correctly identified that the product was green, they were coded as having passed the manipulation check. If participants were allocated to the conventional experimental condition and correctly identified that the product was not marketed as a green product, they were coded as having passed the manipulation check. This variable was then included in subsequent analyses to explore whether there was a relationship between correctly identifying the type of product and type of product on the dependent variables. As there was no manipulation check in the control conditions, the following analyses report only comparisons between the experimental conditions. Thus, caution must be taken when interpreting the results due to the reduced sample size, particularly in the groups of participants that did not pass the manipulation check.

5.3.7.1. Perceived product efficacy

The data were analysed using a 2 (type of product) x 2 (passing the manipulation check) independent measures ANOVA. The dependent variable was perceived product efficacy. There was no significant main effect of type of product or passing the manipulation check on perceived product efficacy. There was no significant interaction between type of product and passing the manipulation check on perceived product efficacy.

5.3.7.2. Perceived product harm to human health and the environment.

The data were analysed using a 2x2 independent measures ANOVA, with passing the manipulation check and type of product as independent variables. The dependent variable was perceived product harm to skin.

- There was no significant main effect of type of product on perceived harm to skin $F(1,185)=.130$, $p=<.719$.
- There was a significant main effect of passing the manipulation check on perceived harm to skin $F(1,185)=8.257$, $p=<.01$.
- There was no significant interaction between the type of product and passing the manipulation check on perceived harm to skin $F(1,185)=1.833$, $p=<.177$.

The data were analysed using a 2x2 independent measures ANOVA, with passing the manipulation check and type of product as independent variables. The dependent variable was perceived product harm when inhaled.

- There was no significant main effect of type of product $F(1,185)=.000$, $p=.994$.
- There was a significant main effect of passing the manipulation check on perceived product harm when inhaled $F(1,185)=4.317$, $p=<.05$.
- There was no significant interaction between passing the manipulation check and type of product on perceived product harm when inhaled $F(1,185)=2.207$, $p=.139$.

The data were analysed using a 2x2 independent measures ANOVA, with passing the manipulation check and type of product as independent variables. The dependent variable was perceived product harm to the environment.

- There was no significant main effect for type of product on perceived product environmental harm $F(1,186)=.460$, $p=.498$.
- There was a significant main effect of passing the manipulation check on perceived product environmental harm $F(1,186)=4.721$, $p=<.05$.

- There was no significant interaction between type of product and passing the manipulation check on perceived product environmental harm $F(1,186)=.275$, $p=.601$.

The data were analysed using a 2x2 independent measures ANOVA, with passing the manipulation check and type of product as independent variables. The dependent variable was perceived overall harm to aquatic life.

- There was no significant main effect of type of product on perceived product harm to aquatic life $F(1,187)=.174$, $p=.677$.
- There was no significant main effect of passing the manipulation check on perceived product harm to aquatic life $F(1,187)=.266$, $p=.607$.
- There was a significant interaction between the type of product and passing the manipulation check on perceived harm to aquatic life $F(1,187)=9.814$, $p=<.01$. This is shown in Figure 25. With a conventional product, participants who passed the manipulation check perceived the product to be significantly more harmful to aquatic life than those who did not pass the manipulation check. With a green product, participants who did not pass the manipulation check perceived the product to be significantly more harmful to aquatic life than those who passed the manipulation check. Error bars on the figure refer to the standard error.

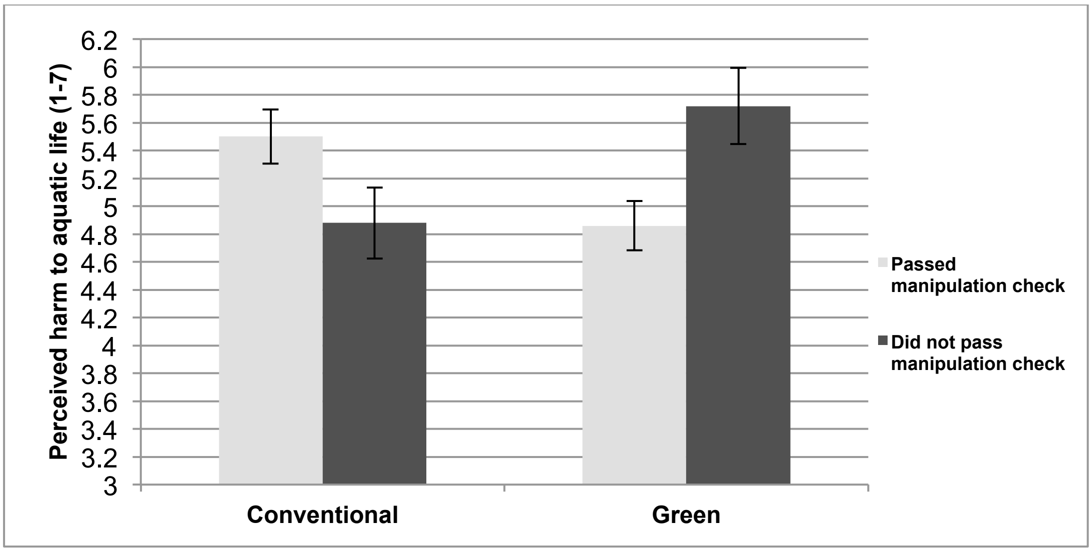

Figure 25: The interaction between type of product and passing the manipulation check on perceived product harm to aquatic life

5.3.7.3. Perceived ingredient harm to human health and the environment – limonene

The data were analysed using a 2x2 independent measures ANOVA, with type of product and passing the manipulation check as independent variables. The dependent variable was limonene's perceived harm to skin.

- There was no significant main effect of type of product on limonene's perceived harm to skin.
- There was a significant main effect of passing the manipulation check on limonene's perceived harm to skin $F(1,187)=8.931$, $p=<.01$.
- There was a significant interaction between the type of product and passing the manipulation check $F(1,187)=7.902$, $p=<.01$. This is shown in Figure 26. Error bars on the figure refer to the standard error.

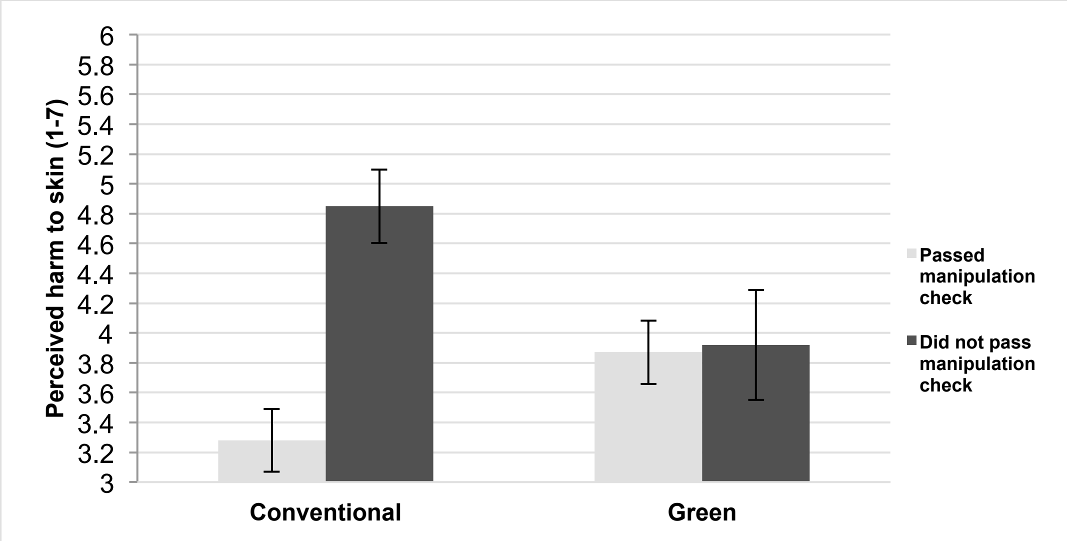

Figure 26: The interaction between type of product and passing the manipulation check on limonene's perceived harm to skin

The data were analysed using a 2x2 independent measures ANOVA, with type of product and passing the manipulation check as independent variables. The dependent variable was limonene's perceived harm when inhaled.

- There was no significant main effect of type of product on limonene's perceived harm when inhaled F(1,187)=.771, p=.381.
- There was a significant main effect of passing the manipulation check on limonene's perceived harm when inhaled F(1,187)=5.763, p=<.05.
- There was no significant interaction between the type of product and passing the manipulation check on limonene's perceived harm when inhaled F(1,187)=3.684, p=.056.

The data were analysed using a 2x2 independent measures ANOVA, with type of product and passing the manipulation check as independent variables. The dependent variable was limonene's perceived harm to the environment.

- There was no significant main effect of product type on limonene's perceived harm to the environment F(1,186)=1.831, p=.178.
- There was a significant main effect of passing the manipulation check on limonene's perceived harm to the environment F(1,186)=5.748, p=<.05.

- There were no significant interactions between product type and passing the manipulation check on limonene's perceived harm to the environment $F(1,186)=1.571$, $p=.212$.

The data were analysed using a 2x2 independent measures ANOVA, with type of product and passing the manipulation check as independent variables. The dependent variable was limonene's perceived harm to aquatic life.

- There was no significant main effect of product type on limonene's perceived harm to aquatic life $F(1,187)=.004$, $p=.952$.
- There was no significant main effect of passing the manipulation check on limonene's perceived harm to aquatic life $F(1,187)=3.594$, $p=<.06$.
- There was no significant interaction between product type and passing the manipulation check on limonene's perceived harm to aquatic life $F(1,187)=.059$, $p=.808$.

5.3.7.4. Perceived ingredient harm to health and the environment – benzisothiazolinone

The data were analysed using a 2x2 independent measures ANOVA, with type of product and passing the manipulation check as independent variables. The dependent variable was benzisothiazolinone's perceived harm to skin.

- There was no significant main effect of type of product on benzisothiazolinone's perceived harm to skin $F(1,185)=.061$, $p=.805$.
- There was no significant main effect of passing the manipulation check on benzisothiazolinone's perceived harm to skin $F(1,185)=3.261$, $p=.073$.
- There was no significant interaction between type of product and passing the manipulation check on benzisothiazolinone's perceived harm to skin $F(1,185)=1.838$, $p=.177$.

The data were analysed using a 2x2 independent measures ANOVA, with type of product and passing the manipulation check as independent variables. The dependent variable was benzisothiazolinone's perceived harm when inhaled.

- There was no significant main effect of type of product $F(1,186)=.013$, $p=.911$ or passing the manipulation check $F(1,186)=2.212$, $p=.139$ on benzisothiazolinone's perceived harm when inhaled.
- There was a significant interaction between type of product and passing the manipulation check on benzisothiazolinone's perceived harm when inhaled $F(1,186)=6.359$, $p=<.05$. This is shown in Figure 27. With a green product, participants who did not pass the manipulation check perceived benzisothiazolinone to be more harmful when inhaled than participants who did pass the manipulation check. Participants who passed the manipulation check perceived benzisothiazolinone to be more harmful when inhaled when presented in a conventional product than in a green product. Error bars on the figure refer to the standard error.

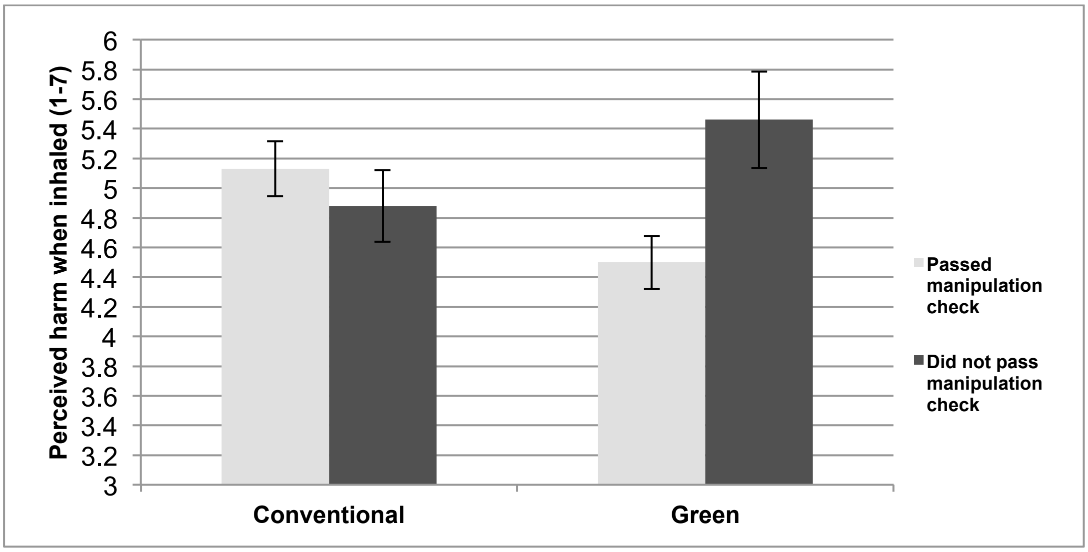

Figure 27: The interaction between type of product and passing the manipulation check on benzisothiazolinone's perceived harm when inhaled

The data were analysed using a 2x2 independent measures ANOVA, with type of product and passing the manipulation check as independent variables.

The dependent variable was benzisothiazolinone's perceived harm to the environment.

- There was no significant main effect of type of product on benzisothiazolinone's perceived harm to the environment F(1,186)=.078, p=.780.
- There was no significant main effect of passing the manipulation check on benzisothiazolinone's perceived harm to the environment F(1,186)=3.173, p=.076.
- There was a significant interaction between type of product and passing the manipulation check on benzisothiazolinone's perceived harm to the environment F(1,186)=4.378, p=<.05. This is shown in Figure 28. With the conventional product, ratings of benzisothiazolinone's perceived harm to the environment were similar between those who passed the manipulation check and those who did not. With the green product, participants who did not pass the manipulation check perceived benzisothiazolinone to be more harmful when inhaled than participants who passed the manipulation check. Error bars on the figure refer to the standard error.

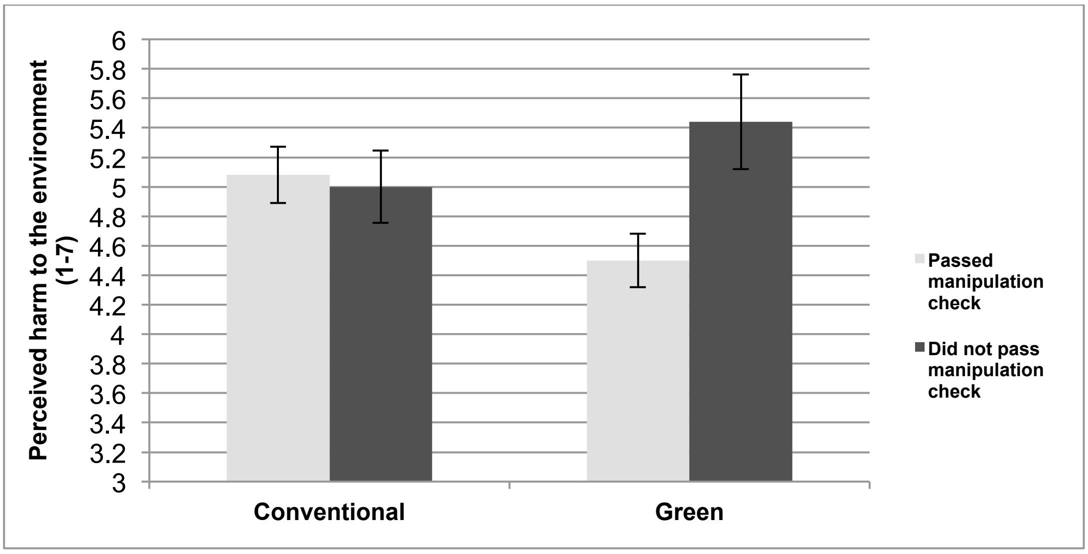

Figure 28: The interaction between type of product and passing the manipulation check on benzisothiazolinone's perceived harm to the environment

The data were analysed using a 2x2 independent measures ANOVA, with type of product and passing the manipulation check as independent variables.

The dependent variable was benzisothiazolinone's perceived harm to aquatic life.

- There was no significant main effect of type of product on benzisothiazolinone's perceived harm to aquatic life $F(1,187)=.391$, $p=.532$.
- There was no significant main effect of passing the manipulation check on benzisothiazolinone's perceived harm to aquatic life $F(1,187)=.630$, $p=.428$.
- There was a significant interaction between type of product and passing the manipulation check on benzisothiazolinone's perceived harm to aquatic life $F(1,187)=13.842$, $p=<.001$ This is shown in Figure 29. With a conventional product, participants who passed the manipulation check perceived benzisothiazolinone to be more harmful to aquatic life than participants who did not pass the manipulation check. With a green product, participants who did not pass the manipulation check perceived benzisothiazolinone to be more harmful to aquatic life than participants who passed the manipulation check. Error bars on the figure refer to the standard error.

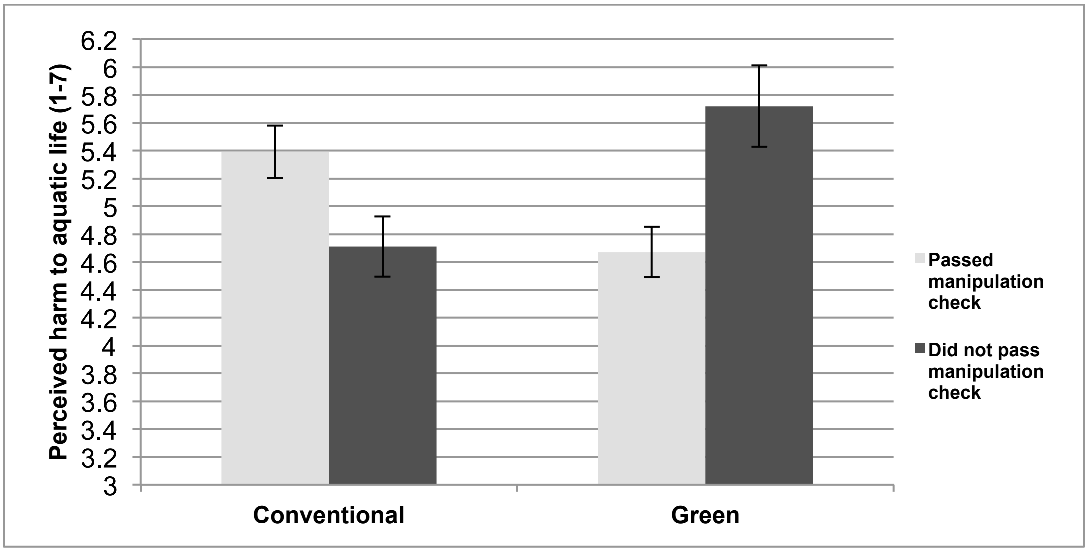

Figure 29: The interaction between type of product and passing the manipulation check on benzisothiazolinone's perceived harm to aquatic life

5.3.7.5: Perceived ingredient harm to human health and the environment – hexyl cinnamal

The data were analysed using a 2x2 independent measures ANOVA, with type of product and passing the manipulation check as independent variables. The dependent variable was hexyl cinnamal’s perceived harm to skin.

- There was no significant main effect of type of product on hexyl cinnamal’s perceived harm to skin $F(1,186)=1.231$, $p=.269$.
- There was a significant main effect of passing the manipulation check on hexyl cinnamal’s perceived harm to skin $F(1,186)=4.292$, $p=<.05$.
- There was no significant interaction between type of product and passing the manipulation check on hexyl cinnamal’s perceived harm to skin $F(1,186)=.089$, $p=.766$.

The data were analysed using a 2x2 independent measures ANOVA, with type of product and passing the manipulation check as independent variables. The dependent variable was hexyl cinnamal’s perceived harm when inhaled.

- There was no significant main effect of type of product on hexyl cinnamal’s perceived harm when inhaled $F(1,186)=1.108$, $p=.294$.
- There was a significant main effect of passing the manipulation check on hexyl cinnamal’s perceived harm when inhaled $F(1,186)=4.338$, $p=<.05$.
- There was no significant interaction between type of product and passing the manipulation check on hexyl cinnamal’s perceived harm when inhaled $F(1,186)=.126$, $p=.723$.

The data were analysed using a 2x2 independent measures ANOVA, with type of product and passing the manipulation check as independent variables. The dependent variable was hexyl cinnamal’s perceived harm to the environment.

- There was no significant main effect of type of product on hexyl cinnamal's perceived harm to the environment $F(1,187)=2.368$, $p=.126$.
- There was no significant main effect of passing the manipulation check on hexyl cinnamal's perceived harm to the environment $F(1,187)=.728$, $p=.395$.
- There was no significant interaction between type of product and passing the manipulation check on hexyl cinnamal's perceived harm to the environment $F(1,187)=.161$, $p=.689$.

The data were analysed using a 2x2 independent measures ANOVA, with type of product and passing the manipulation check as independent variables. The dependent variable was hexyl cinnamal's perceived harm to aquatic life.

- There was no significant main effect of type of product on hexyl cinnamal's perceived harm to aquatic life $F(1,187)=.609$, $p=.436$.
- There was no significant main effect of passing the manipulation check on hexyl cinnamal's perceived harm to aquatic life $F(1,187)=1.457$, $p=.229$.
- There was no significant interaction between type of product and passing the manipulation check on hexyl cinnamal's perceived harm to aquatic life $F(1,187)=2.481$, $p=.117$.

5.3.8. Results excluding those who did not pass the manipulation check

The amount of participants who did not pass the manipulation check in both conditions is higher than expected, and potential reasons for this are to be discussed (Section 5.4.2). However, results from the previous analyses (while tentative due to small sample size) suggest that there may be differences between those who passed the manipulation check and those who did not. It was thus decided to analyse the results excluding participants who did not pass the manipulation check. It must be stressed that this is not to be the main focus of the results, but simply to further explore the relationship between a products environmental attributes and its perceptions by consumers. The results will not be discussed in terms of the research hypotheses, as it is impossible to answer the hypotheses if all of the participant's responses are not considered.

5.3.8.1. Perceived product efficacy

The data were analysed using a 2(type of product) x 2(experimental condition) independent measures ANOVA. When referring to experimental condition, this refers to the blind or aware conditions. When referring to type of product, this refers to whether the product was green or conventional. Total score on the NEP was included as a moderating variable, in order to allow for the effects of environmental attitudes. The dependent variable was the ratings of perceived product efficacy.

- There was no significant main effect of type of product on perceived product efficacy $F(1,335)=.397$, $p=.529$.
- There was no significant main effect of condition (aware or blind) on perceived product efficacy $F(1,335)=.033$, $p=.855$.
- There was no significant interaction between type of product or experimental condition on perceived product efficacy $F(1,335)=1.454$, $p=.229$.
- There was no significant main effect of environmental attitudes on perceived product efficacy $F(1,335)=3.719$, $p=.055$.
- There was no significant interaction between type of product and environmental attitudes $F(1,335)=.640$, $p=.424$ or experimental condition and environmental attitudes $F(1,335)=.155$, $p=.694$ on perceived product efficacy.
- There was no significant three way interaction between type of product, experimental condition and environmental attitudes $F(1,335)=2.538$, $p=.112$. These results are in line with those including participants who did not pass the manipulation check.

5.3.8.2. Perceived product harm to human health and the environment

The data were analysed using a 2(type of product) x 2(experimental condition) independent measures ANOVA. When referring to experimental condition, this refers to the blind or aware conditions. When referring to type of product, this refers to whether the product was green or conventional. Total score on the NEP was included as a moderating variable, in order to allow for the effects of environmental attitudes. The dependent variable was the scores of how harmful the product was to skin.

- There was no significant main effect of type of product on perceived harm to skin $F(1,327)=.003$, $p=.954$.
- There was no significant main effect of experimental condition on perceived harm to skin $F(1,334)=1.951$, $p=.163$.
- There was a significant interaction between type of product and experimental condition on perceived harm to skin $F(1,327)=5.728$, $p=<.05$. This is displayed in Figure 30. Error bars on the figure refer to the standard error.
- There was no significant main effect of environmental attitudes on perceived product harm to skin $F(1,327)=.529$, $p=.467$.
- There was no significant interaction between type of product and environmental attitudes $F(1,327)=.025$, $p=.874$ or experimental condition and environmental attitudes $F(1,327)=.572$, $p=.450$ on perceived product harm to skin.
- There was a significant interaction between type of product, experimental condition and environmental attitudes on perceived product harm to skin $F(1,327)=8.502$, $p=<.01$. This is shown in Figure 31. For the purpose of presentation, scores on the NEP scale have been dichotomized as in Sections 5.3.8 onwards. Error bars on the figure refer to the standard error.

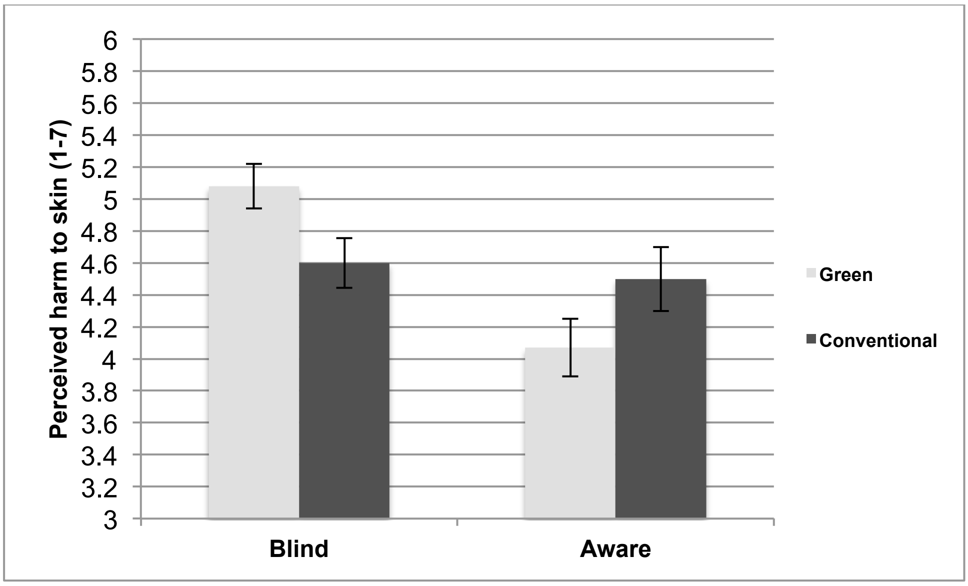

Figure 30: The interaction between type of product and experimental condition on perceived product harm to skin in those who correctly identified the products.

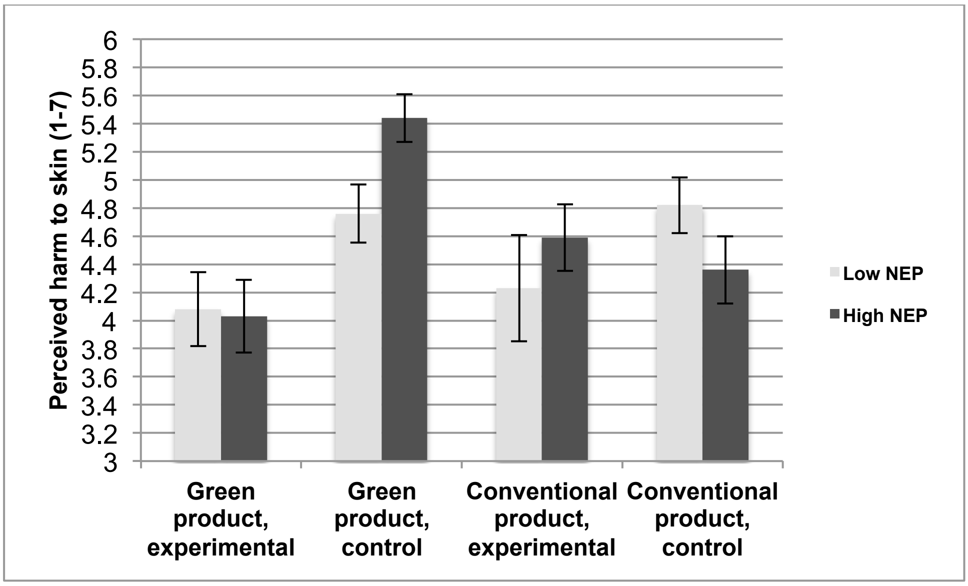

Figure 31: The interaction between type of product, experimental condition and environmental attitudes on perceived product harm to skin in those who correctly identified the products

The data were analysed using a 2(type of product) x 2(experimental condition) independent measures ANOVA. When referring to experimental condition, this refers to the blind or aware conditions. When referring to type of product, this refers to whether the product was green or conventional. Total score on the NEP was included as a moderating variable, in order to allow for the effects of environmental attitudes. The dependent variable was the scores of how harmful the product was when inhaled.

- There was no significant main effect of type of product on product harm when inhaled $F(1,326)=.583$, $p=.446$.
- There was no significant main effect of experimental condition on product harm when inhaled $F(1,326)=1.381$, $p=.241$.
- There was a significant interaction between type of product and experimental condition, $F(1,326)=8.244$, $p=<.01$. This is shown in Figure 32. Error bars on the figure refer to the standard error.

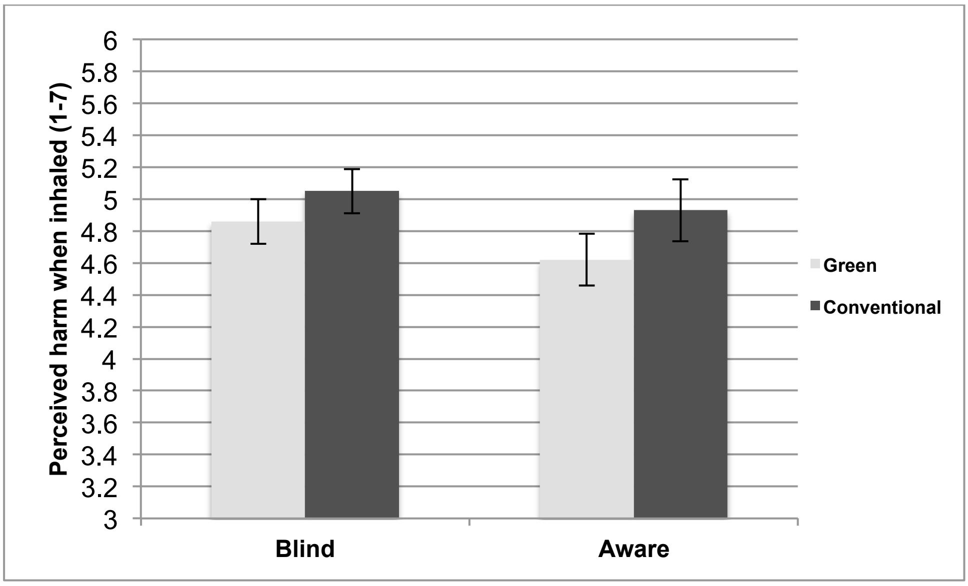

Figure 32: The interaction between type of product and experimental condition on perceived product harm when inhaled in those who correctly identified the products

- There was no significant main effect of environmental attitudes on perceived product harm when inhaled $F(1,326)=2.727$, $p=.100$.
- There was no significant interaction between type of product and environmental attitudes on perceived product harm when inhaled $F(1,326)=1.061$, $p=.304$, or between experimental condition and environmental attitudes on perceived product harm when inhaled $F(1,326)=2.298$, $p=.131$.
- There was a significant interaction between type of product, experimental condition and environmental attitudes $F(1,326)=8.944$, $p=<.01$. This is shown in Figure 33. Error bars on the figure refer to the standard error.

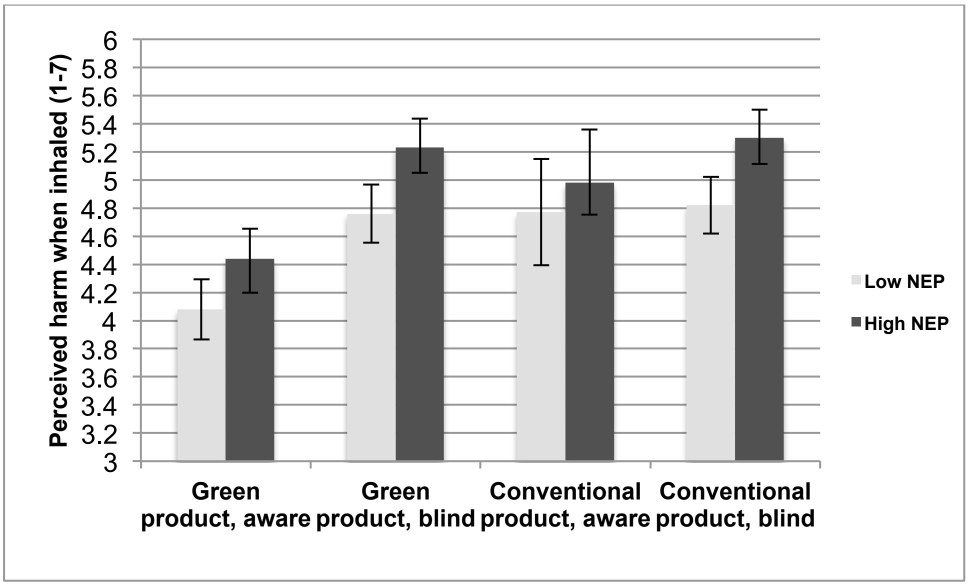

Figure 33: The interaction between type of product, experimental condition and environmental attitudes on perceived product harm when inhaled in those who correctly identified the products.

The data were analysed using a 2(type of product) x 2(experimental condition) independent measures ANOVA. When referring to experimental condition, this refers to the blind or aware conditions. When referring to type of product, this refers to whether the product was green or conventional. Total score on the NEP was included as a moderating variable, in order to allow for the effects of environmental attitudes. The dependent variable was the scores of how harmful the product was to the environment.

- There was no significant main effect of type of product on perceived product harm to the environment $F(1,326)=1.877, p=.172$.
- There was no significant main effect of experimental condition on perceived product harm to the environment $F(1,326)=1.605$, $p=.206$.
- There was a significant interaction between type of product and experimental condition on perceived product harm to the environment $F(1,326)=10.804$, $p=<.001$. This is shown in Figure 34. Error bars on the figure refer to the standard error.
- There was a significant main effect of environmental attitudes on perceived product harm to the environment $F(1,326)=7.288$, $p=<.01$.

- There was no significant interaction between type of product and environmental attitudes on perceived product harm to the environment $F(1,326)=1.834$, $p=.177$.
- There was a significant interaction between experimental condition and environmental attitudes on perceived product harm to the environment $F(1,326)=4.194$, $p=<.05$.
- There was a significant interaction between type of product, experimental condition and environmental attitudes on perceived product harm to the environment $F(1,326)=11.342$, $p=<.001$. This is shown in Figure 35. Error bars on the figure refer to the standard error.

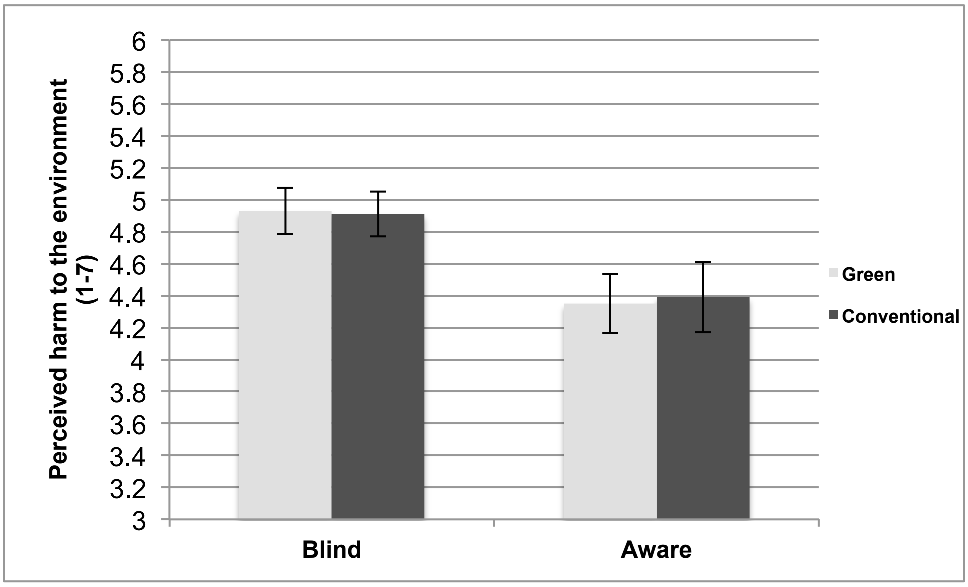

Figure 34: The interaction between type of product and experimental condition on perceived product harm to the environment in those who correctly identified the products.

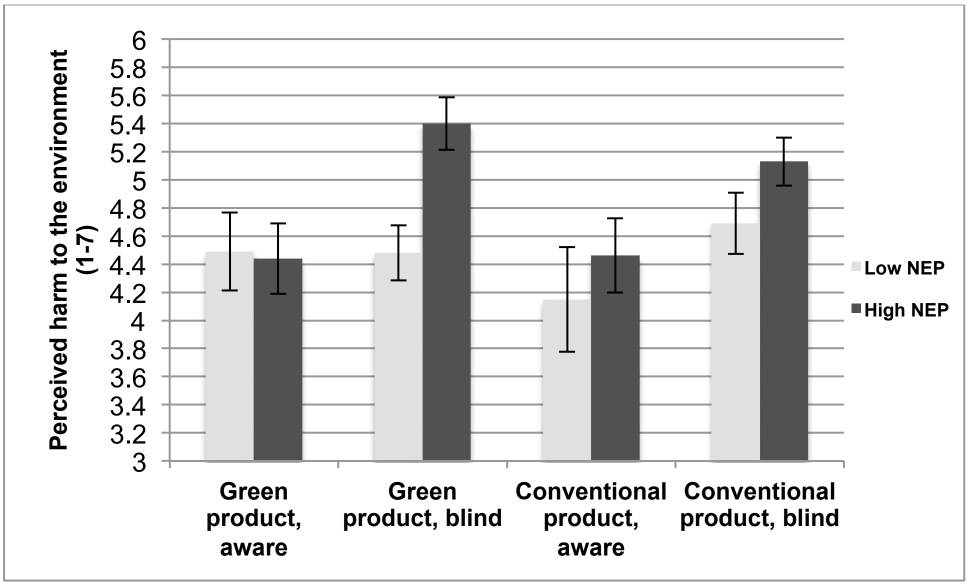

Figure 35: The interaction between type of product, experimental condition and environmental attitudes on perceived product harm to the environment in those who correctly identified the products

The data were analysed using a 2(type of product) x 2(experimental condition) independent measures ANOVA. When referring to experimental condition, this refers to the blind or aware conditions. When referring to type of product, this refers to whether the product was green or conventional. Total score on the NEP was included as a moderating variable, in order to allow for the effects of pro-environmental attitudes. The dependent variable was the scores of how harmful the product was to aquatic life.

- There was a significant main effect of type of product on perceived product harm to aquatic life $F(1,328)=5.266$, $p=<.05$.
- There was a significant main effect of experimental condition on perceived product harm to aquatic life $F(1,328)=7.408$, $p=<.01$.
- There was a significant interaction between type of product and experimental condition on perceived product harm to aquatic life $F(1,328)=4.746$, $p=<.05$.
- There was a significant main effect of environmental attitudes on perceived product harm to aquatic life $F(1,328)=5.35$, $p=<.05$.
- There was a significant interaction between type of product and environmental attitudes on perceived product harm to aquatic life $F(1,328)=7.103$, $p=<.01$.

- There was a significant interaction between experimental condition and environmental attitudes on perceived product harm to aquatic life F(1,328)=10.603, p=<.001.
- There was a significant interaction between type of product, experimental condition and environmental attitudes on perceived product harm to aquatic life F(1,328)=6.589, p=.01 (Figure 36). Error bars on the figure refer to the standard error.

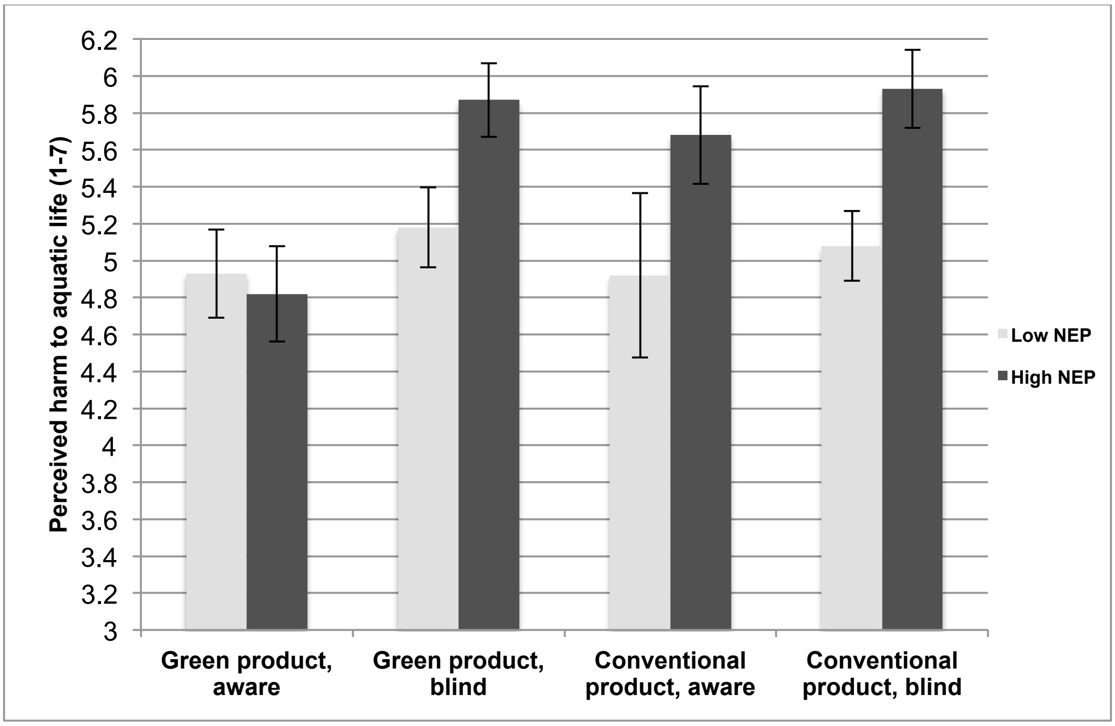

Figure 36: The interaction between type of product, experimental condition and environmental attitudes on perceived product harm to aquatic life in those who correctly identified the products

5.3.8.3. Perceived ingredient harm to human health and the environment – limonene

The data were analysed using a 2(type of product) x 2(experimental condition) independent measures ANOVA. When referring to experimental condition, this refers to the blind or aware conditions. When referring to type of product, this refers to whether the product was green or conventional. Total score on the NEP was included as a moderating variable, in order to allow for the effects of environmental attitudes. The dependent variable was perceived ingredient harm to skin, with limonene being the ingredient in question.

- There was no significant main effect of type of product on limonene's perceived harm to skin $F(1,328)=.001$, $p=.981$.
- There was no significant main effect of experimental condition on limonene's perceived harm to skin $F(1,328)=.042$, $p=.837$.
- There was a significant main effect of environmental attitudes on limonene's perceived harm to skin $F(1,328)=8.252$, $p=<.01$. Participants with lower environmental attitudes perceived limonene to be more harmful to skin than participants with higher environmental attitudes.
- There were no significant interaction effects of any kind on limonene's perceived harm to skin.

The data were analysed using a 2(type of product) x 2(experimental condition) independent measures ANOVA. The dependent variable was perceived ingredient harm when inhaled, with limonene being the ingredient in question.

- There was no significant main effect of type of product on limonene's perceived harm when inhaled $F(1,328)=.165$, $p=.685$.
- There was no significant main effect of experimental condition on limonene's perceived harm when inhaled $F(1,328)=.1.703$, $p=.193$.
- There was no significant main effect of environmental attitudes on limonene's perceived harm when inhaled $F(1,328)=1.546$, $p=.215$.
- There were no significant interaction effects of any kind on limonene's perceived harm when inhaled.

The data were analysed using a 2(type of product) x 2(experimental condition) independent measures ANOVA. The dependent variable was perceived ingredient harm to the environment, with limonene being the ingredient in question.

- There was no significant main effect of type of product on limonene's perceived harm to the environment $F(1,328)=.442$, $p=.507$.

- There was no significant main effect of experimental condition on limonene's perceived harm to the environment F(1,328)=.013, p=.911.
- There was no significant main effect of environmental attitudes on limonene's perceived harm to the environment F(1,328)=.162, p=.688.
- There were no significant interaction effects between any of the variables on limonene's perceived harm to the environment.

The data were analysed using a 2(type of product) x 2(experimental condition) independent measures ANOVA. The dependent variable was perceived ingredient harm to aquatic life, with limonene being the ingredient in question.

- There was no significant main effect of type of product on limonene's perceived harm to aquatic life F(1,328)=1.809, p=.18.
- There was no significant main effect of experimental condition on limonene's perceived harm to aquatic life F(1,328)=.403, p=.526.
- There was no significant main effect of environmental attitudes on limonene's perceived harm to aquatic life F(1,328)=.584, p=.445.
- There were no significant interaction effects between any of the variables on limonene's perceived harm to aquatic life.

5.3.8.4. Perceived ingredient harm to human health and the environment – benzisothiazolinone

The data were analysed using a 2(type of product) x 2(experimental condition) independent measures ANOVA. When referring to experimental condition, this refers to the blind or aware conditions. When referring to type of product, this refers to whether the product was green or conventional. Total score on the NEP was included as a moderating variable, in order to allow for the effects of environmental attitudes. The dependent variable was perceived ingredient harm to skin, with benzisothiazolinone being the ingredient in question.

- There was no significant main effect of type of product on benzisothiazolinone's perceived harm to skin F(1,325)=1.656, p=.199.

- There was no significant main effect of experimental condition on benzisothiazolinone’s perceived harm to skin F(1,325)=.378, p=.539.
- There was a significant main effect of environmental attitudes on benzisothiazolinone’s perceived harm to skin F(1,325)=3.873, p=.05. Participants with higher environmental attitudes perceived benzisothiazolinone to be more harmful to skin than participants with low environmental attitudes.
- There were no significant interaction effects between any of the variables.

The data were analysed using a 2(type of product) x 2(experimental condition) independent measures ANOVA. The dependent variable was benzisothiazolinone’s perceived harm when inhaled.

- There was no significant main effect of type of product on benzisothiazolinone’s perceived harm when inhaled F(1,325)=.337, p=.562.
- There was no significant main effect of experimental condition on benzisothiazolinone’s perceived harm when inhaled F(1,325)=.002, p=.966.
- There was no significant main effect of environmental attitudes on benzisothiazolinone’s perceived harm when inhaled F(1,325)=1.091, p=.297.
- There were no significant interactions between any of the variables.

The data were analysed using a 2(type of product) x 2(experimental condition) independent measures ANOVA. The dependent variable was benzisothiazolinone’s perceived harm to the environment.

- There was no significant main effect of type of product on benzisothiazolinone’s perceived harm to the environment F(1,326)=2.666, p=.103.

- There was no significant main effect of experimental condition on benzisothiazolinone's perceived harm to the environment $F(1,326)=.896$, $p=.345$.
- There was a significant main effect of environmental attitudes on benzisothiazolinone's perceived harm to the environment $F(1,326)=9.491$, $p=<.01$. Participants with higher environmental attitudes perceived benzisothiazolinone to be more harmful to the environment than participants with low environmental attitudes.
- There were no significant interaction effects between any of the variables.

The data were analysed using a 2(type of product) x 2(experimental condition) independent measures ANOVA. The dependent variable was benzisothiazolinone's perceived harm to aquatic life.

- There was no significant main effect of type of product on benzisothiazolinone's perceived harm to aquatic life $F(1,328)=2.104$, $p=.148$.
- There was no significant main effect of experimental condition on benzisothiazolinone's perceived harm to aquatic life $F(1,328)=1.46$, $p=.228$.
- There was a significant interaction between type of product and experimental condition on benzisothiazolinone's perceived harm to aquatic life $F(1,328)=5.004$, $p=<.05$. This is shown in Figure 37. Error bars on the figure refer to the standard error.
- There was a significant main effect of environmental attitudes on benzisothiazolinone's perceived harm to aquatic life $F(1,328)=9.137$, $p=<.01$. Participants with higher environmental attitudes perceived benzisothiazolinone to be more harmful to aquatic life than participants with low environmental attitudes.
- There was a significant interaction between type of product, experimental condition and environmental attitudes on

benzisothiazolinone's perceived harm to aquatic life, shown in Figure 38. Error bars on the figure refer to the standard error.

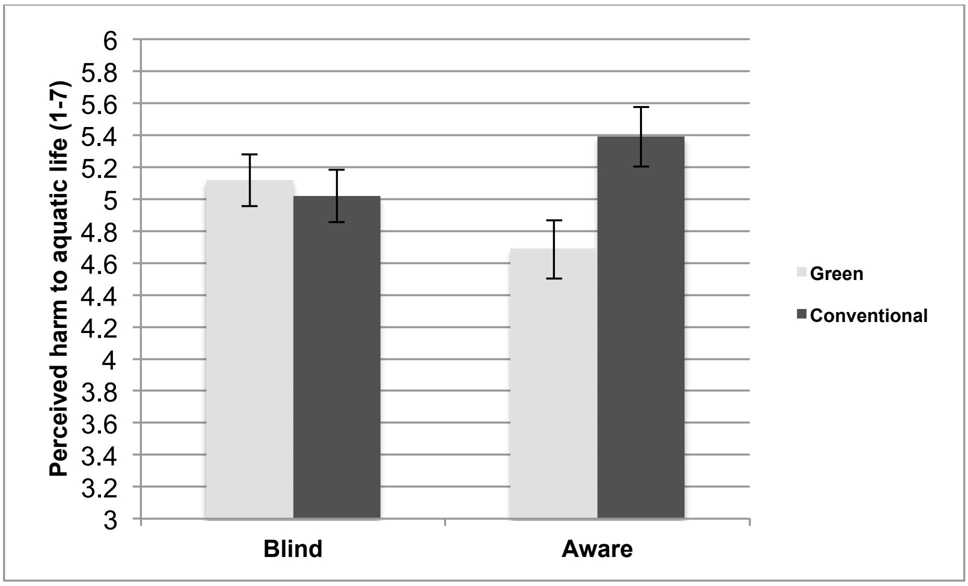

Figure 37: The interaction between type of product and experimental condition on benzisothiazolinone's perceived harm to aquatic life in participants who correctly identified the products

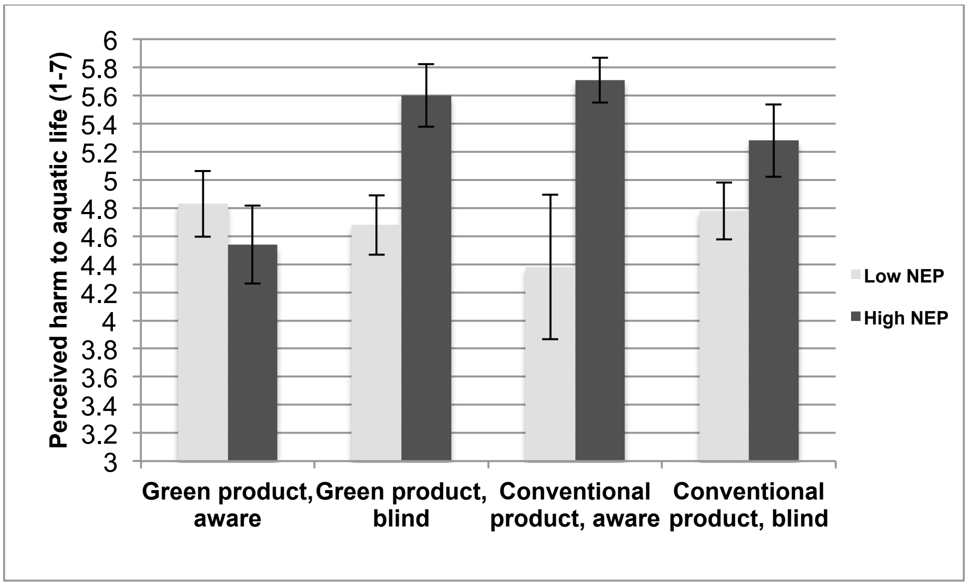

Figure 38: The interaction between type of product, experimental condition and environmental attitudes on benzisothiazolinone's perceived harm to aquatic life in participants who correctly identified the products

5.3.8.5. Perceived ingredient harm to human health and the environment – hexyl cinnamal

The data were analysed using a 2(type of product) x 2(experimental condition) independent measures ANOVA. When referring to experimental condition, this refers to the blind or aware conditions. When referring to type of product, this refers to whether the product was green or conventional. Total score on the NEP was included as a moderating variable, in order to allow for the effects of environmental attitudes. The dependent variable was hexyl cinnamal's perceived harm to skin.

- There was no significant main effect of type of product on hexyl cinnamal's perceived harm to skin $F(1,324)=3.040$, $p=.082$.
- There was no significant main effect of experimental condition on hexyl cinnamal's perceived harm to skin $F(1,324)=.117$, $p=.732$.
- There was no significant interaction between type of product or experimental condition on hexyl cinnamal's perceived harm to skin $F(1,324)=3.572$, $p=.06$.
- There was no significant main effect of environmental attitudes on hexyl cinnamal's perceived harm to skin $F(1,324)=.462$, $p=.497$.
- There was a significant interaction between type of product, experimental condition and environmental attitudes on hexyl cinnamal's perceived harm to skin $F(1,324)=4.935$, $p=<.05$. This is shown in Figure 39. Error bars on the figure refer to the standard error.

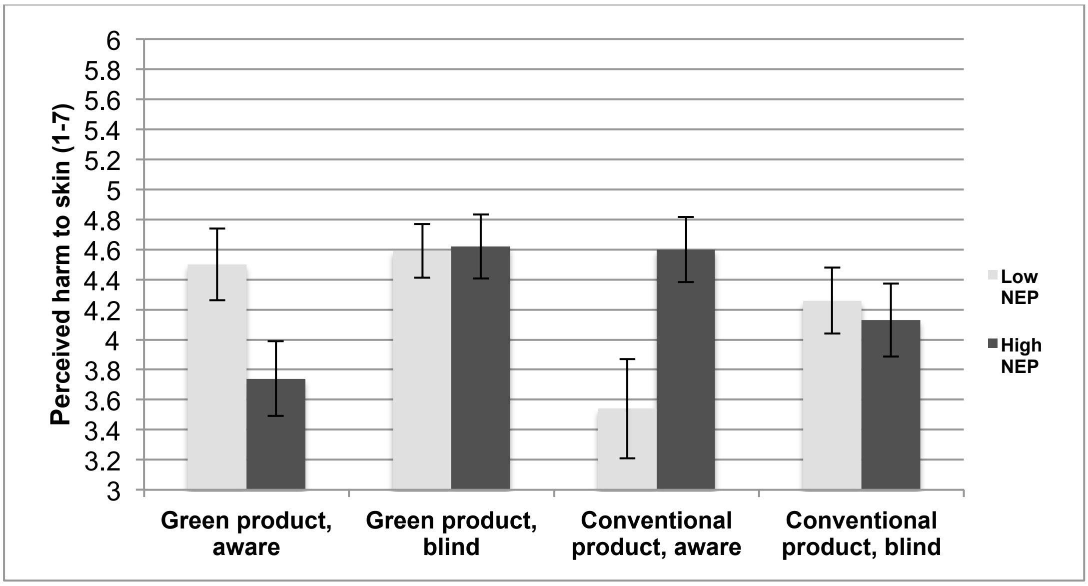

Figure 39: The interaction between type of product, experimental condition and environmental attitudes on hexyl cinnamal's perceived harm to skin in participants who correctly identified the products

The data were analysed using a 2(type of product) x 2(experimental condition) independent measures ANOVA. The dependent variable was hexyl cinnamal's perceived harm when inhaled.

- There was a significant main effect of type of product on hexyl cinnamal's perceived harm when inhaled $F(1,328)=3.88$, $p=.05$.
- There was no significant main effect of experimental condition on hexyl cinnamal's perceived harm when inhaled $F(1,328)=.084$, $p=.772$.
- There was no significant interaction between type of product and experimental condition on hexyl cinnamal's perceived harm when inhaled $F(1,328)=2.085$, $p=.150$.
- There was no significant main effect of environmental attitudes on hexyl cinnamal's perceived harm when inhaled $F(1,328)=1.201$, $p=.274$.
- There was a significant interaction between type of product and environmental attitudes on hexyl cinnamal's perceived harm when inhaled $F(1,328)=4.484$, $p=<.05$.
- There were no other significant interactions.

The data were analysed using a 2(type of product) x 2(experimental condition) independent measures ANOVA. The dependent variable was hexyl cinnamal's perceived harm to the environment.

- There was no significant main effect of type of product on hexyl cinnamal's perceived harm to the environment $F(1,328)=2.211$, $p=.138$.
- There was a significant main effect of experimental condition on hexyl cinnamal's perceived harm to the environment $F(1,328)= 5.198$, $p=<.05$. Participants in the control condition rated the product as significantly more harmful to the environment than participants in the experimental condition.
- There was no significant interaction between type of product and experimental condition on hexyl cinnamal's perceived harm to the environment $F(1,328)=1.442$, $p=.231$.
- There was no significant main effect of environmental attitudes on hexyl cinnamal's perceived harm to the environment $F(1,328)=3.233$, $p=.073$.
- There was a significant interaction between experimental condition and environmental attitudes on hexyl cinnamal's perceived harm to the environment $F(1,328)=7.313$, $p=<.01$.

The data were analysed using a 2(type of product) x 2(experimental condition) independent measures ANOVA. The dependent variable was hexyl cinnamal's perceived harm to aquatic life.

- There was no significant main effect of type of product on hexyl cinnamal's perceived harm to aquatic life $F(1,327)=1.977$, $p=.161$.
- There was a significant main effect of experimental condition on hexyl cinnamal's perceived harm to aquatic life $F(1,327)=5.788$, $p=<.05$. Participants in the control condition perceived hexyl cinnamal to be significantly more harmful to aquatic life than participants in the experimental condition.

- There was no significant interaction effect between type of product and experimental condition on hexyl cinnamal's perceived harm to aquatic life $F(1,327)=.638$, $p=.425$.
- There was a significant main effect of environmental attitudes on hexyl cinnamal's perceived harm to aquatic life, with participants with higher environmental attitudes perceiving hexyl cinnamal to be more harmful to aquatic life than those with lower environmental attitudes $F(1,327)=3.855$, $p=.05$.
- There was a significant interaction effect between experimental condition and environmental attitudes on hexyl cinnamal's perceived harm to aquatic life $F(1,327)=7.228$, $p=<.01$.

5.3.9. Ratings of usefulness of provided information and familiarity with ingredients

Participants were asked to indicate how useful the provided information had been in helping them to answer the questions on a 1-7 scale, with 1 being not at all useful and 7 being very useful. The mean rating of usefulness was 4.06 ($SD=1.919$). The frequencies of response are shown in Figure 40. A 2 (type of product) x2 (experimental condition) ANOVA was conducted to explore whether ratings of information usefulness differed across conditions. There was no significant main effect of experimental condition on perceived ingredient usefulness $F(1,391)=1.091$, $p=.297$. There was a significant main effect of type of product on perceived information usefulness $F(1,391)=7.251$, $p=<.01$. Participants perceived the information to be significantly more useful with the conventional product ($M=4.341$) than with the green product ($M=3.824$). There was no significant interaction effect between experimental condition and type of product on perceived information usefulness.

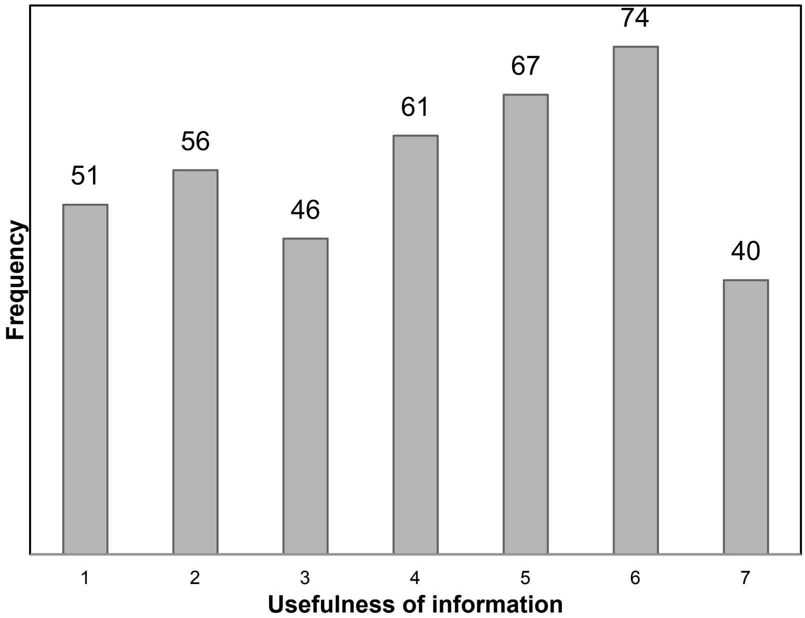

Figure 40: Participant indication of how useful the provided information was at helping them to answer the questions

Participants were asked to rate their familiarity with the ingredients on a 1-7 scale, with 1 being completely unfamiliar and 7 being completely familiar. The mean rating of familiarity was 3.15 (SD=1.945). Frequencies of response are shown in Figure 41. A 2 (type of product) x2(experimental condition) ANOVA was conducted to explore whether ratings of familiarity were different across conditions. There was no significant main effect of experimental condition on ratings of ingredient familiarity $F(1,391)=1.440$, $p=.231$. There was no significant main effect of type of product on ingredient familiarity $F(1,391)=.371$, $p=.543$. There was no significant interaction between experimental condition and type of product on ingredient familiarity $F(1,391)=.027$, $p=.870$.

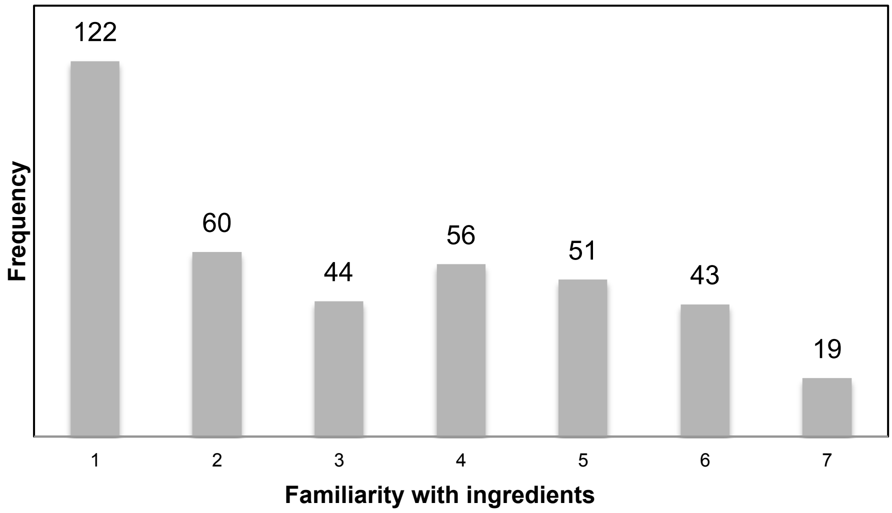

Figure 41: Participant indication of how familiar they were with the ingredients in the study

5.4. DISCUSSION

5.4.1. Summary of results

No significant differences were found in any of the analyses for perceived product cleaning efficacy. Both the green and conventional products were perceived to perform similarly both to each other, and regardless of whether participants knew the environmental attributes of the product or not. Thus, the current research finds no evidence for the sustainability liability. This further supports the results of the previous chapter.

There was a general trend that in the aware conditions, products were perceived to be more harmful to human health and the environment by participants with high environmental attitudes than those with low environmental attitudes. Moving on to the ingredient level, in general participants with higher environmental attitudes perceived the ingredients to be more harmful to both health and the environment. Environmental attitudes were found to be a more consistent predictor of perceived harm than experimental condition or type of product.

A high proportion of participants were unable to correctly identify whether a product was advertised as a green product or a conventional product. The analyses in Section 5.3.7 suggested that correctly identifying the product may influence perceptions of harm. This led to looking more closely at the results of those who correctly identified green and conventional products, where a different pattern of results was found. It must again be stressed that the results from these analyses are not intended to provide the answers to the research hypotheses, and no definitive conclusions can – or are to – be drawn from them. They are considered and reported only to provide a wider context and exploration for the main results.

In this subset of participants, the results hint towards a potential relationship between the type of product, being aware of its environmental attributes and the individual's attitudes towards the environment on perceived product harm. Participants who scored highly on environmental attitudes perceived the green product to be lower in perceived harm than the conventional product, but only if the participants were aware that the product was advertised as green. For those low in environmental attitudes, there were no significant differences between the green and conventional aware conditions when considering product harm to skin. Interestingly, perceptions of harm to skin were significantly higher in the green control condition than any other for individuals with high environmental attitudes.

A similar pattern of results was found when considering the product's environmental harm. Those with high environmental attitudes in the green aware condition perceived the green product to be significantly less harmful to the environment than those with high environmental attitudes in the blind green condition. However, in the aware conditions, there were no significant differences between the conventional and the green product. For those low in environmental attitudes, there were no significant differences between conditions. Across individuals with high environmental attitudes, the green product in the aware condition was perceived to be less harmful to aquatic life than any other condition. Again, for those low in environmental attitudes, there were no significant differences between conditions.

Finally, any indications at a relationship between the type of product, awareness of its environmental attributes and individual environmental attitudes do not seem to hold true at an ingredient level. Significant interactions between the three variables were only found for benzisothiazolinone's perceived harm to aquatic life, and hexyl cinnamal's perceived harm to skin. This is too sporadic to attempt to draw any conclusions from.

5.4.2. Manipulation check failures

Arguably, the most interesting research outcome is the high proportion of participants who could not correctly identify whether they had been presented with a green or conventional product. Lim (2013) notes that while the majority of consumers believe that they have a thorough understanding of what a green product is, the reality of this is that their understanding is inadequate at best. This was clearly evident in the current research. It is important to attempt to first consider why participants may have been unable to distinguish between green and conventional products before then considering the implications that this may have for sustainable consumption.

5.4.2.1. Possible explanations for high manipulation check failure rate

When presented with a conventional product, 38.6% of participants in this condition indicated that the product was marketed as environmentally friendly. This is staggeringly high. There is nothing contained in the product information or in the product's advertising (shown in Appendix 7) that could explicitly suggest that this product is marketed as an environmentally preferable product. The product makes no reference to anything related to the environment. The only thing that could be inferred to relate to the environment is the presence of a small picture of a lemon with two leaves and a flower on the packaging, present in order to convey information about the product's scent. Cervellon and Carey (2011) suggest that consumers will create and apply their own definitions of 'natural' to a product. Basso et al. (2016, 2014) suggest that products with food related attributes – such as fruit depicted on the packaging – can often induce category ambiguity. While this was originally proven for product category – e.g. food or household product – it is plausible that such category ambiguity could also relate to 'green' or 'not-green' product in the participant’s mind. It is therefore possible that in the absence of any concrete information regarding the product’s environmental attributes, the environmental status of the product was (wrongly) inferred using this reference to something ‘natural’.

However, it was not only participants in the conventional condition that struggled to correctly identify whether the product was marketed as environmentally friendly or not. When presented with a green product, 24.3% of participants in this condition indicated that the product was not marketed as environmentally friendly. This product itself is called ‘Ecozone’, and has the tagline ‘Make your home an Ecozone’ (Ecozone, 2019). The product itself is green in colour, something that has been found to influence perceptions of greenness (Pancer et al., 2017). In the product information, it refers to ‘natural plant extracts’. While more participants correctly identified this product compared to the conventional product, many still failed to recognise that this product was advertised as green. It is possible that participants may have just understood ‘Ecozone’ to be the brand name, and overlooked the environmental implications this may have for the product.

Another possible explanation for participants identifying the green product as a conventional product could come from the product information for the green product. The product describes itself as ‘killing 99.9% of bacteria dead’. It could be that participants perceived this to be at odds with the concept of a green product for two reasons. Firstly, killing bacteria may be viewed as damaging to the immediate environment; how can a product be accepted as environmentally friendly if it is damaging microorganisms? ‘Killing’ and ‘dead’ are emotive terms that could be perceived to be incongruent with the idea of being environmentally friendly. Secondly, previous research suggests that individuals may perceive green products to be weak, ineffective and gentle (Luchs et al., 2010). If this is so, they may believe that the product in question cannot be a green product due to its claim of ‘killing 99.9% of bacteria’. It is possible that participants perceived this claim to be incongruent with the idea of an environmentally friendly product; in their minds it is not possible for a product that claims to be this effective to also be green.

It also may simply be the result of using real products over hypotheticals in the research. The use of hypothetical products allows for greater experimental control; researchers can easily manipulate and over exaggerate the differences between green and conventional products. This means that distinguishing between the products is easer and thus participants can more accurately identify which products are advertised as green and which products are not. This research used real, existing products in order to explore perceptions of green multi-surface cleaning products. While this may allow for greater ecological validity, this may have come at a cost to the manipulation check error rates. It is possible that for actual products, the differences between conventional and green products are too subtle for all participants – and potentially consumers – to differentiate between.

Little research has been done using real-life, existing products in order to understand this further. In one study, Luchs et al. (2010) led participants to believe that the laundry detergent in question was a real green product – “Seventh Generation” (in reality, it was not this product being used but participants were unaware of this). This study reports a successful manipulation check; there were significant differences in sustainability ratings between this product and the control product. However, the authors note that Seventh Generation is a brand many participants were likely to be familiar with. This also means that participants may have had prior awareness of the brand’s environmental positioning, which may have informed their answer to the manipulation check question. In the current research, both of the products were relatively unfamiliar to participants. 21.8% of participants had used an Ecozone product before, and 27.9% had used a Flash product. If participants were unfamiliar with the products prior to this research, they were also likely to be unfamiliar with either of the brands positioning on sustainability.

A further explanation – and potentially one most probable – is that participants had difficulty in defining what a green product both is and isn’t. Green products are defined as products whose “environmental and societal performance in production, use and disposal, is significantly improved and improving in comparison to conventional or competitive products offerings" (Peattie, 1995, p. p181). At a consumer level, these are broad and difficult to operationalize criteria. Consumers have a limited understanding of what constitutes a green product and perceive them to simply contain minimal chemicals and a greater amount of natural ingredients (Cervellon and Carey, 2011). The majority of consumers struggle to identify green products. Terms such as eco-friendly are vague and difficult to clearly define; there is a lack of information present on the packaging that would indicate why a green product is actually so, and why a conventional product is not (Borin et al., 2011). Thus, if participants are unaware as to what a green cleaning product looks like, it is unsurprising that they struggle to differentiate between green advertised and conventional products. This could account for the high error rate within the manipulation checks.

While Borin et al. (2011) would suggest that cleaning products are the only product category that consumers can easily identify, the present research is far less optimistic about this. For some participants, the presence of a lemon on the product packaging may have been enough to classify as green advertising. Other participants may not have believed that calling a product Ecozone and referring to plant-based ingredients is enough to warrant the status of a green product, as many consumers are increasingly sceptical of green claims (Newell et al., 1998). Alevizou et al. (2015) find that consumers meet claims that include green colours, pictures of the earth and vague wording with distrust and suspicion. It is thus possible that participants noticed these claims but did not believe their presence was anything more than a marketing stunt as opposed to indicating the environmental benefits of the product (Alevizou et al., 2015). It must be noted that the current research did aim to circumvent these issues by asking "Is this product *advertised* as environmentally friendly?" as opposed to "Is this product environmentally friendly?", but this semantic difference may have been easily overlooked by participants.

Finally, there is always the possibility that the methodology may have contributed to the manipulation check failure rate. The research involved using Amazon Mechanical Turk to administer online surveys to workers in exchange for monetary payment. This is a method that has been largely supported across the social sciences, with much research finding greater diversity and similar reliability rates for MTurk as other more traditional measures, especially that of surveying undergraduates (Bentley et al., 2017; Buhrmester et al., 2016; Casler et al., 2013; Holden et al., 2013; Mason and Suri, 2012). However, as with all methods it is not without its flaws and data quality is often questioned with MTurk studies (Dennis et al., 2018). There is always the possibility that the high manipulation failure rate could be the result of MTurk workers simply answering at random in order to complete the survey and gain payment (Landers and Behrend, 2015). However, it is argued that this could be an issue with any paid survey methodology and is not specific to MTurk itself.

Recommended precautions were put in place in order to assuage any potential negative effects of the methodology. Only MTurk workers with a high reputation (an approval rating of >95% or more) were eligible to take part in the research (Peer et al., 2014). The survey was also pilot tested in order to ensure there were no issues with the survey materials (Holden et al., 2013). Participants were also paid higher than average for their responses. In 2013, the most common payment for MTurk research was $0.06 (Difallah et al., 2015). The current research paid participants $1 per response. While this was largely done out of ethical responsibility, some research has found that higher payments may yield better quality data (Litman et al., 2015). Furthermore, the use of MTurk also allowed for the use of a largely US based sample compared to using a UK sample. This allowed the research to use real, existing products while also minimising any effects of product familiarity as neither of the products are sold in the US. Familiarity has been noted as a potential confounding factor by previous research (Luchs et al., 2010). Thus, while it cannot be guaranteed that the method has not contributed to the manipulation check error rate, every effort was put in place to mitigate against this.

5.4.2.2. Implications of high manipulation check error rate for sustainable consumption

Perhaps more important than understanding the reasons why so many participants could not correctly identify green or conventional cleaning products are the implications that this may have for the research, marketing and purchasing behaviour of these products. These are to be discussed in turn.

Research suggests that of the 30% of individuals who indicate sustainable purchase intentions, only 3% translate this into actual buying behaviour (Carrington et al., 2014). This attitude-behaviour gap is well documented in the literature, and a full review of this can be found in Section 2.2. Much research into sustainable consumption has involved asking individuals about their previous purchase decisions and future intentions for purchasing sustainable or non-sustainable goods. Auger and Devinney (2007) suggest that the attitude-behaviour gap is often exacerbated by such methodology; participants may change their answers due to social desirability bias, or due to perceived pressure to answer in the way they believe the researcher wishes them to. The current research also hints at another potential flaw to this method. If individuals are struggling to differentiate between green and conventional products, how can they accurately report on their green purchase intentions or behaviour? Research participants may indicate that they never purchase green products, unaware that a brand they frequently purchase is actually positioned as a green brand. Of greater concern is the possibility that participants mistakenly believe a conventional brand of product that they purchase to be a green one, and thus report frequent green purchasing behaviour in any surveys.

The high error rate for the manipulation checks could also hint that manufacturers of cleaning products are not doing enough to differentiate green cleaning products from conventional cleaning products. Borin et al. (2011) highlight the difficulties consumers find at the point of purchase, suggesting it is difficult for them to interpret the labels and vague terminology on green products. Pickett-Baker and Ozaki (2008) note that green manufacturers make few green claims in their advertising, which could lead to difficulties in identifying green products. In order for them to successfully differentiate products, green information must be clear, accessible and understandable. From the current research, it is clear that some green cleaning products are failing on this part. Nearly 25% of participants could not identify a green cleaning product, in an environment where they were explicitly asked to focus on the product packaging and information with no competing demands for attention. This is unrepresentative of the purchase environment, where consumers are likely to be faced with multiple products that they must identify and choose between (Iyengar and Lepper, 2000). It is therefore likely that in the actual decision making context of a supermarket, an even greater proportion of individuals would overlook green products.

It would thus follow that manufacturers of green cleaning products must do more in order for their products to be more easily differentiated from conventional products. They must provide greater and clearer information regarding the products environmental benefits, with these being at the heart of the product's advertising. Calling a product 'Ecozone' is apparently not enough. However, if this is taken in conjunction with research into the sustainability liability, manufacturers of green products are in somewhat of a bind. The current research suggests that individuals struggle to differentiate between green and conventional cleaning products, thus making it difficult for consumers to actively select a green cleaning product. Research into the sustainability liability suggests that consumers are likely to perceive green cleaning products as weaker and less effective than their conventional counterparts (Luchs et al., 2010). Thus, while placing greater emphasis on a product's environmental attributes may help consumers to differentiate between green and conventional cleaning products, it could also run the risk of the consumer actively selecting the conventional cleaning product.

Prior research suggests that emphasising a green products aesthetic appeal alongside its environmental attributes is a potential avenue for mitigating the effects of the sustainability liability (Luchs et al., 2012). In the context of this research, it is possible that taking the focus away from the environmental appeal of the product may confuse consumers and leave them struggling to identify whether a product is advertised as green or conventional. This then begs the question – if this encourages consumers to purchase the product regardless, does it even matter if they are aware of its environmental status? It must be noted, however, that no evidence for the sustainability liability was found in the current research and that of the previous chapter. There were no significant differences in perceptions of product efficacy across the green and conventional products, even when responses from those who could not correctly identify the products were excluded.

A final implication to briefly consider is that for retailers and green cleaning product placement within stores. It is clear that individuals struggle to differentiate between green and conventional cleaning products. A way of mitigating this could be for retailers to have a dedicated 'environmentally-friendly' section within their stores, similar to sections dedicated to specific dietary requirements. Thus, this would remove the burden of differentiating between green and conventional products from the consumers. Interested individuals would simply have to find the green section and select which products they require. However, this approach brings with it its own potential flaws. Green products have historically been part of a niche market and only recently made their way to mainstream outlets (Chintakayala et al., 2018). Having green products available alongside conventional products at least means that the green cleaning product may be considered as an option, even if it may not be easily identified that it is green. Mishra and Sharma (2014) note that for green products to be successful, consumers must be exposed to them where they would usually shop. If green products were relegated to a specific area in a supermarket, it is possible that this section would be overlooked by all but the most environmentally minded of consumers.

A potential solution to this could be that within the overall cleaning product section, there could be a shelf dedicated to green cleaning products specifically advertised as so. van Herpen et al. (2012) suggest that clustering organic and FairTrade products together on shelves is beneficial for the sales of each of these type of products. However, to the author's knowledge, no research into the specific product placement of green cleaning products has been conducted. Future research could focus on partnering with supermarkets and retailers to further explore this as an option.

5.4.3. Discussion of results

Having discussed the implications of participants struggling to differentiate between green and conventional products, the remainder of the results and their implications will be considered. Unless explicitly stated otherwise, the results discussed refer to the results with all participants included (Sections 5.3.3 to 5.3.6 inclusive).

5.4.3.1. Perceived product efficacy and the sustainability liability

As briefly touched upon in Section 5.4.2.2, the current research found no supporting evidence for the sustainability liability. No significant differences were found in perceived product efficacy between the green and conventional products, nor between the green aware and blind experimental conditions. Finally, no significant differences were found between these conditions even when participants who could not correctly identify green and conventional products were excluded. Thus, it can be concluded that the current research cannot be used in support of the sustainability liability. This is in contrast to a small number of studies that have found convincing evidence for this phenomenon (Section 5.1.1). Potential reasons for this will be reviewed.

One potential explanation for the lack of support for the sustainability liability is the fact that this research used real, existing products and their advertising information as opposed to hypotheticals. All previous research has employed the use of hypothetical products, in such that researchers could clearly manipulate the differences between the green product and the conventional product. While the sustainability liability may be convincing in experimental, hypothetical studies, it may not be quite so clear-cut a phenomena amongst real products where the differences between conventional and green products are not quite so obvious.

Following on from this, prior research into the sustainability liability indicates that providing information on product strength may mitigate the negative effect of environmental status on perceived product efficacy (Lin and Chang, 2012; Luchs et al., 2010). Luchs et al. (2010) found that participants preferred a sustainable brand of tires that guaranteed strength over the same brand that guaranteed availability. Lin and Chang (2012) note that when provided with a credible endorsement for product performance, participants used similar amounts of a green and conventional glass cleaner. Without the endorsement, participants used significantly more of the green glass cleaner than the conventional glass cleaner. In these studies, the endorsements and strength information were carefully manipulated. In the current research, the green product was described as ‘killing 99.9% of bacteria dead’, as this was present in the original product information. Thus, as the strength endorsement was present across both green conditions, no significant differences in perceived product efficacy were found between green and conventional products. This would be in line with previous literature on the sustainability liability. Further research could confirm this, creating another condition using the same product but omitting the strength information. This could have been applied to the current research, but the entire point of this piece of research was to explore the sustainability liability in existing products as they are advertised.

5.4.3.2. The role of environmental attitudes

The hypotheses predicted environmental attitudes to have a moderating effect on the two independent variables as opposed to a significant effect on their own. However, it appears that in some cases environmental attitudes are significant predictors of harm on their own. Participants with greater environmental attitudes often perceived products or ingredients to be of greater harm than those with lower environmental attitudes. This was not the main focus of this research so will not be discussed in too great depth. However, it does indicate that there is some potential relationship between caring for the environment and perceived harm to both human health and the environment from chemicals and chemical containing products. Kim and Chung (2011) find that for organic personal care products, the concepts of environmental consciousness and health consciousness are closely linked in the minds of consumers. This research suggests that this may be extended to household cleaning products. More widely, this could hint at a relationship between a concern for the environment and a wariness of chemicals. Siegrist and Bearth (2019) propose a number of reasons for this chemophobia: limited knowledge, decision-making heuristics, those with strong health concerns and often women and older adults. The results of this study could suggest that holding pro-environmental attitudes may be another such factor.

However, as in many cases, there were no significant differences in perceptions of ingredient harm between green and conventional products. It could be that individuals who hold strong environmental attitudes are warier of green product claims and therefore do not trust that the green product in this study was of greater environmental benefit (Alevizou et al., 2015). Thus, any relationship appears to be complex, and further research would be required to establish this.

5.4.3.3. Overall main effect of experimental condition

When considering the perceived harm to the environment and human health of the overall product, there was a significant main effect of experimental condition. Participants in the aware condition perceived the product to be less harmful to all measures of human health and the environment than participants in the blind condition. This remained true regardless of product type. One possible explanation for this could be that seeing a photo of a product reassured the participants that the product category in question was one that was familiar and everyday for them. The products themselves may have been unfamiliar to the participants, but multipurpose spray cleaners are one of the most commonly purchased and used cleaning products (Keynote, 2014). Perceived risk has been found to be reduced when the risk is familiar to individuals (Song and Schwarz, 2009). Consumers have been found to base their risk perceptions on the products involved in the cleaning task (Bearth and Siegrist, 2019). In the blind conditions, products were described as either a ‘multipurpose spray cleaner’ or a ‘multi-surface cleaner’. It is possible that in these conditions, participants had difficulties in visualising what a ‘multipurpose spray cleaner’ or ‘multi-surface cleaner’ was. They may not have been able to identify it as a product that they (most likely) use regularly around their own house. In the aware conditions whereby participants were provided with a photo of the product type in question, participants would have been able to identify the product category in question and recognise it as something that they believe to be familiar and thus less harmful.

5.4.3.4. Perceived product harm to health and the environment of green cleaning products

The following section discusses the results whereby participants who had failed the manipulation check (and therefore did not correctly identify green or conventional products) were removed. It must be stressed that due to this, none of the following conclusions are firm and concrete. They are tentative and mere suggestions for the basis of potential future research.

When considering perceived product harm to skin, participants who could successfully identify green products in the green aware condition perceived the product to be significantly less harmful than participants in the green blind condition. This would suggest that when participants can correctly identify green products, awareness that a product is green results in lower perceived harm to skin than when participants are unaware that a product is green. Thus, environmental advertising can influence perceptions of a product’s harm to skin, but only if the participants are able to correctly identify the cleaning product as a green product. Furthermore, this effect is exacerbated in those who report strong environmental attitudes. This is also true when considering a product’s perceived harm when inhaled. This is in line with previous research suggesting that a product’s environmental status may lead to it being perceived as safer and gentler (Aaker et al., 2010; Lin and Chang, 2012; Luchs et al., 2010). Harm to skin and the respiratory system are the two greatest health impacts associated with multipurpose cleaning products if allergies are included in these classifications. This research therefore suggests that the environmental advertising of a product may have implications for its perceived harm to health but only if individuals can recognise that the product has been advertised as a green cleaning product.

For environmental harm, those who reported lower environmental attitudes rated the green product similarly regardless of whether they were aware that it was a green product or not. However, those who reported strong environmental attitudes perceived the green product to be significantly more harmful towards the environment when they were unaware it was marketed as a green product. This was true when asked both about perceived environmental harm and perceived harm to aquatic life. However, ratings of perceived harm to the environment between the conventional and green aware conditions did not differ significantly regardless of environmental attitudes. This could suggest that individuals do not perceive multipurpose spray cleaners to be of particular concern to the environment regardless of whether they are green or conventional. As described in Section 5.4.3.3, the photo of the product reassured the participants that the product category was one they were familiar with and used regularly. It is also possible that participants struggled to visualise how a surface-cleaning product may find its way into the wider environment or the habitats of aquatic life. Other types of cleaning products such as laundry products or washing up liquid may have yielded different results as they are directly released down drains in larger quantities. Further research utilising the same methodology but including cleaning products of different categories could further explore this.

Implication wise, there is one silver lining suggested by the outcomes of this research. Firstly, there were no significant differences in perceived product efficacy between green and conventional products. Secondly, when participants could correctly distinguish between green and conventional products, green cleaning products were perceived as significantly less harmful to skin than conventional cleaning products regardless of environmental attitudes. When environmental attitudes are taken into account, those with high environmental attitudes also perceive green cleaning products to be less harmful when inhaled and to aquatic life than conventional cleaning products. This therefore suggests that individuals with strong environmental attitudes perceive benefits to using green cleaning products over conventional cleaning products. The products perform similarly, but are believed to be less harmful to skin, the respiratory system and to aquatic life than conventional products. However, this is only true when individuals can correctly distinguish between green and conventional cleaning products.

Future research would thus need to identify the following: 1) would these perceived benefits translate into greater purchase intentions 2) would these benefits outweigh other barriers to purchasing, such as cost and 3) how can we best assist consumers to be able to distinguish between green and conventional products? This also poses ethical questions. The consensus is still divided between whether green cleaning products are less harmful to human health than conventional cleaning products. The results from the research in Chapter 3 would suggest that they are not. Is it ethical to allow consumers to continue to believe green cleaning products are less harmful to human health if it results in them purchasing green cleaning products over conventional cleaning products? Does the greater good of protecting the environment – and any resulting health benefits that may come from this – outweigh the ethical duty to ensure consumers can make fully informed decisions about the products they purchase?

5.4.3.5. Perceptions of ingredients

Once more, the following section discusses the results whereby participants who had failed the manipulation check were removed. It must be stressed that due to this, the following conclusions or discussion points are tentative and mere suggestions for the basis of potential future research. No firm conclusions are to be drawn from the basis of these results.

The present research is the first of its kind to explore whether perceptions of an overall product’s harm to human health and the environment are also apparent at an ingredient level. Generally speaking, any potential relationships between type of product, experimental condition and environmental attitudes found for the overall product were not replicated at an ingredient level. Environmental attitudes were found to have a significant main effect on limonene's perceived harm to skin, benzisothiazolinone's perceived harm to skin and the environment and hexyl cinnamal's perceived harm to aquatic life. Considering that in total there were 12 different questions related to ingredient perceptions of harm, significance of one variable on four of these is not particularly definitive. Nothing else significant was found for limonene. For benzisothiazolinone, a significant three-way interaction was only found when considering perceived harm to aquatic life. Participants with strong environmental attitudes in the green aware condition perceived benzisothiazolinone to be significantly less harmful to aquatic life than those in any other condition.

Furthermore, for those with low environmental attitudes, there were no significant differences in perceived harm across any condition. In the green aware condition, perceptions of harm to aquatic life were not significantly different between those with high and low environmental attitudes. In all other conditions, perceptions of benzisothiazolinone's harm to aquatic life were significantly higher in those with strong environmental attitudes compared to those with lower environmental attitudes. The only other significant three-way interaction was on hexyl cinnamal's perceived harm to skin; in the green aware condition, those with high environmental attitudes perceived hexyl cinnamal to be significantly more harmful to skin than those with low environmental attitudes. In the green blind and conventional blind conditions, there were no significant differences between those with high and low environmental attitudes. In the conventional aware condition, those with high environmental attitudes rated hexyl cinnamal as significantly more harmful to skin than those with low environmental attitudes.

While these two instances show an interesting relationship between type of product, experimental condition and environmental attitudes, nothing can conclusively be drawn from this. No patterns were discovered across the different ingredients and different aspects of perceived harm. For all intents and purposes, there could be some decisive factor that led to certain variables being predictive of one ingredient's perceived harm for one category, but not for another. However, to ground the research in an appropriate context, the average cleaning product consists of 9 different chemicals, with 174 different chemicals identified across all available multipurpose cleaning products (see Section 3.2.2). If focus were placed on understanding the complex combination of variables that influenced consumer perceptions for every single chemical contained in cleaning products on every aspect of perceived harm, the results would become meaningless in anything other than a purely academic context. While overall patterns across the different chemicals may have been helpful for understanding consumers' intuitive toxicology regarding chemicals in multipurpose cleaning products, the present research suggests that no such patterns can yet be identified.

There are two potential explanations for this. Firstly, previous research has suggested that consumers often perceive 'chemicals' as a general concept, as opposed to specific chemicals themselves (Bearth et al., 2019; Dickson-Spillmann et al., 2011; Saleh et al., 2019). In this study, participants were asked to consider specific chemicals; something they are unlikely to have done prior to the research. Thus, different decision making processes may have been evoked when considering specific chemicals as opposed to simply the concept of chemicals. It is possible that previously held heuristics that applied to the concept of chemicals did not hold when participants were required to consider specific, individual chemicals.

Following on from this, much of the previous research into the perceived risk of chemicals in consumer products is largely based upon the concept of 'natural' (Goodyear et al., 2015; O'Connor et al., 2017; Rozin, 2005; Rozin et al., 2012). Siegrist and Bearth (2019, p. 1071) refer to the 'natural-is-better' heuristic that results in a "much more negative perception of synthetic chemicals when compared with chemicals of natural origin". Klaschka (2016) notes that consumers find substances of natural origin to be safer than synthetic substances. In the case of both products used in this study, neither of the chemicals that consumers were asked about made any reference to being 'natural'. Long and chemical sounding names are off-putting to consumers (Noiesen et al., 2007), and 'benzisothiazolinone' is hardly natural sounding. It is therefore possible that a chemical being contained in a green product is not enough to evoke the natural-is-better heuristic (Siegrist and Bearth, 2019). Furthermore, Song and Schwarz (2009) find that the harder a consumer find an ingredient to pronounce, the riskier they perceive it to be. Thus, participants may have utilised this heuristic in their decision-making processes over any others.

The lack of significant differences between perceived harm from ingredients in green and conventional products is, however, by no means a negative thing. Previous research has identified the misconception that consumers often assume green or natural products to be safer than their conventional alternatives (Bearth et al., 2017; Rozin, 2005; Rozin et al., 2012). This has led to concern that consumers may underestimate the risks posed by such products and lead to insufficient safety precautions being taken when using such products (Ropeik, 2011; Saleh et al., 2019). Such research has not explored consumer perceptions of the chemicals contained in these products. However, the current research suggests that across both green and conventional products the chemicals contained within them are viewed similarly in terms of perceived risk to health. This is more in line with expert classification of risk, as experts make little distinction between chemicals of synthetic and natural origin (Bearth et al., 2019; Saleh et al., 2019). However, it must still be noted that when participants could correctly identify the products, they did perceive the overall product to be less harmful to health than the conventional product. This still has implications for safe usage.

5.4.3.6. Usefulness of information provided

When asked to consider how useful they had found the provided information, participants were split relatively evenly, with more leaning towards it being useful than not useful (Figure 40). Few participants indicated that the information was not useful at all, suggesting that many of them did find it helpful as a basis for their decisions. 46% of the participants indicated that the information was quite or highly useful by scoring it a 6 or 7 on a 1-7 scale. This is slightly promising; providing consumers with safety information and ingredients lists may assist them in making informed decisions. However, this does not provide any indication of whether the participants understood the information or not. They may have found the information useful simply because they had nothing else to base their decision on.

Furthermore, just because they indicated that they found the information useful does not necessarily mean that it was the primary – or any – basis of their decision. Bearth and Siegrist (2019) find that consumers do not use the safety pictograms to guide their product risk perceptions. Additionally, it is also unclear as to exactly what part of the information the participants were using. Participants perceived the information to be more useful with the conventional product than with the green product. One explanation for this would be that the conventional product provided a greater quantity of information than the green product. It could be argued that here they simply had more information to use to guide their decision-making. Further research needs to explore how consumers use this information. Eye-tracking research is becoming increasingly popular to explore the attention consumers pay to labels, particularly within the area of organic food (Drexler et al., 2018; Meyerding and Merz, 2018; Sørensen et al., 2012). In the context of the current research, eye-tracking methodology could be utilised to explore which parts of the product information participants paid the greatest attention to.

An important point to note is that in this study, all of the information was provided for the participants and they were explicitly asked to consider it. Even the least engaged participant would have had to skim through it in order to reach the questions. In real-life purchase decisions, consumers would have to make the active choice to consider this information. While the information provided in this study is provided at the point of purchase on the back of the bottle, there is nothing to suggest that consumers will actually use it. Early research suggests that consumers spend less than 12 seconds at each product category display (Dickson and Sawyer, 1990; Hoyer, 1984). More recent research supports this, finding an average time of 10 seconds elapsing between arriving at a product category and leaving it (Seiler and Pinna, 2017). This would suggest that when selecting products, consumers don’t have the time to pick up a product, turn it over, read the information on the back of the bottle and carefully consider it before repeating for a different product(s) and then finally making their choice. Furthermore, Dickson and Sawyer (1990) also found that only 57.9% of consumers observed the price of products they selected. Price was found to be the most important factor in selecting a cleaning product; if consumers aren't even paying attention to prices, how can we expect them to pay attention to ingredient lists and safety information?

5.5. CONCLUSION

When considering the research as a whole, there are two salient points to be concluded from it. Firstly, just because a product may be advertised as green does not guarantee that consumers will be able to differentiate it from a conventional product. This is imperative to future research; before we can encourage consumers to purchase green products, we must ensure that they can recognise and distinguish the green products from conventional alternatives. Secondly, the research highlights the difficulties encountered when conducting research using real products over hypotheticals. For the purpose of purely academic knowledge, it is easy to see why the majority of research has focused on hypothetical products (Lin and Chang, 2012; Luchs et al., 2010). Using real products makes variables of interest more difficult to manipulate. For example, the advertising for the green product in this study made reference to both strength and environmental attributes. As such, it may not have been perceived wholly as a green product in the way that the hypothetical green products of previous research have been (Luchs et al., 2010). Furthermore, the advertising for the conventional product contained a greater volume of information than the advertising for the green product. This may have had some effect on the results. Additionally, familiarity with the products in question is likely to further confound the results (Luchs et al., 2010). While this makes conducting research using real products more difficult - and the subsequent results from it messier - it is fundamental that further research carries on in this manner. One must ask what value can be drawn from purely hypothetical research that has limited applicability to real-life green purchasing decisions. If the overall goal is to encourage sustainable consumption on as broad a level as possible, the research into this must focus on the sustainable alternatives that are actually available to consumers.

Throughout, this research has attempted to do this. Finally, this research has also furthered our understanding of consumer perceptions of chemicals in household products.

6: Discussion

The previous chapters have provided a discussion about each of the pieces of research on their own. This chapter will consider and discuss each of the studies in relation to each other. Firstly, the research will be discussed in the context of the research questions outlined in section 1.2. Secondly, the results of each piece of research will be considered in relation with one another, and overall themes will be identified. Thirdly, strengths and limitations of the research will be outlined. The chapter will then conclude with implications from the research and suggestions for future research.

6.1. ANSWERING THE RESEARCH QUESTIONS

Section 1.2 outlined the key questions that this research attempted to answer. The extent to which these questions were answered, and what answers were found, will be discussed below.

1. Are there differences in the composition of green and conventional cleaning products? If so, do these differences have implications for health and the environment?

Chapter 3 attempted to answer this research question. The research found differences between green and conventional cleaning products in terms of composition in the sense that they contained different ingredients to each other. This is not entirely surprising; each producer of cleaning products is likely to have their own preferred base formula that is then tweaked for different varieties of the product. There were overlaps – a number of different ingredients were found in both green and conventional products. However, when the environmental and health implications of each product were compared, there were no real significant differences. Green products were more likely to contain chemicals that were toxic in contact with skin. Beyond this, there were no significant differences between product type and the health or environmental hazards that they posed. However, this study was limited by the information that was available for inclusion and any discussion of this research must take that into account. While this study answered the research question as much as the available information allowed, it is impossible to fully answer this research question using only the available information. There needs to be greater transparency about what chemicals are contained in cleaning products – and, on a wider level, any product – and at what concentration before any meaningful conclusions can be drawn.

2. Does a product's environmental status influence how the product is perceived in terms of its effectiveness?

Chapters 4 and 5 attempted to answer this research question. These studies differed in their levels of participant interaction with the product. In one study, participants interacted with the product and rated it in terms of effectiveness afterwards. In the other study, participants were asked to judge how effective they believed a product would be after reading information about the product. In both studies, there were no overall significant differences in perceived effectiveness between conventional and green products. This suggests that there is no relationship between a product's environmental status and perceived efficacy. However, in the first study, self-identified green consumers rated one of the two green products as significantly more effective than three of the four conventional products. Thus, a product's environmental status may only influence perceived effectiveness in consumers who value environmental protection.

3. Does a products environmental status influence how the product is perceived in terms of its safety?

Product safety was considered in Chapter 5. Green cleaning products were largely considered to be less harmful to human health than conventional cleaning products, but only when participants could clearly identify that the product was advertised as green. This relationship was also greater in participants who held strong pro-environmental attitudes. Thus, for green products, research question 3 was partially confirmed.

4. Does a product's environmental status influence the way in which its ingredients are perceived?

This research question refers to Chapter 5. This study was the first of its kind to explore perceptions of ingredient harm across green and conventional products. The results are complex, but overall there does not seem to be a clear relationship between a product's environmental status and perceptions of harm to health or the environment posed by the product's ingredients.

6.2. GENERAL DISCUSSION

The current research provides a good general overview of green cleaning products. It explores differences in the formulations of green and conventional cleaning products as well as consumer perceptions of product efficacy. It then combines these two streams of research to explore perceptions of the chemicals contained in green and conventional cleaning products, and whether this influences perceptions of the overall product's efficacy and safety. As such, the research explores cleaning products from a number of perspectives and therefore contributes to a range of existing knowledge.

The research in Chapter 3 indicates that along with preservatives, fragrance ingredients are most likely to cause respiratory or dermal harm in comparison to any other functional group of ingredients. Unlike preservatives, fragrance ingredients perform a purely hedonistic role in the cleaning product; they are unnecessary to the product's performance. However, in the research in both Chapters 4 and 5, around a third of participants indicated that scent was important to them. This was also reiterated in the research in Chapter 4 when participants were asked their reasons for product selection; scent was a widely cited reason for product choice in both blind and aware conditions. This was true for both green and conventional products. Scent may function as one of the only ways to differentiate between seemingly similar products.
Thus, the current research provides evidence of a contradiction between a consumers desire for less harmful products and the want for pleasantly scented products. It is unclear whether consumers perceive this as a contradiction or not. This may be dependent on the type of scent. Bonini et al.

(2015) find that individuals are more likely to donate to an environmental cause in the presence of a scent congruent with that cause. It is possible that more natural seeming scents (e.g. lavender, pine) may wrongly indicate to the consumer that a product is more sustainable than it actually is. This provides another avenue for research into consumer perceptions of chemicals in green products. It is also possible that educating consumers about the health impacts of fragrance ingredients may lead to greater acceptance of unscented products.

Finally, it is important to discuss the importance of the differing prices of green and conventional cleaning products. The current research did not focus on price as a barrier to purchase, as it is a factor that is largely beyond the control of academics and - to an extent - manufacturers. Green cleaning products are more costly than conventional cleaning products and will be until the majority of consumers adopt them. However, to ignore the role that price plays in consumption behaviour would be unrealistic. Across Chapters 4 and 5, 65-76% of participants indicated that price was one of the most important qualities in a cleaning product. While the results from Chapter 4 suggested that the future of green cleaning products may be more optimistic than was first thought, the average amount that even green consumers were willing to pay for a green product was less than what the product actually retails at. It would be too simplistic to conclude this research by recommending that green products need to be cheaper, but it would also be naive to ignore the barrier that price may pose towards even the most willing of green consumers.

6.3. CONTRIBUTIONS AND IMPLICATIONS

6.3.1. Theoretical contribution to the sustainability liability

The research is the first of its kind to truly explore the sustainability liability in regards to multi-surface cleaning products. Cleaning products are often referred to as an example of a product whereby strength is a valued attribute and therefore green cleaning products must be viewed unfavourably (Luchs et al., 2010). However, for the most part this has been taken as assumed rather than actually proven. Luchs et al. (2010) explore laundry detergent and Lin and Chang (2012) briefly look at glass cleaner, but so far no research has been carried out with regards to multi-surface cleaning products. As multi-surface cleaning products are the most commonly used of all cleaning products (Keynote, 2014), further exploration of the sustainability liability into this product category was warranted. This research provides a new contribution to knowledge by exploring the sustainability liability in multi-surface cleaning products. It did so across two different studies with differing levels of participant interaction with the products. As no supporting evidence for the sustainability liability was found across either study, we can begin to conclude that the sustainability liability may not be present for this product category. The focus then needs to shift on understanding why the sustainability liability did not appear to influence green product perceptions in this research.

Previous studies have largely focused on hypothetical products (Lin and Chang, 2012; Luchs et al., 2010; Mai et al., 2019; Zhu et al., 2012). It bears repeating that this research is novel and original in that it explores perceptions between real products as opposed to hypotheticals. This is the key contribution that this research makes to theory and knowledge. It is the author’s belief that this is the direction in which all research into green cleaning products must go. Our ability to understand barriers to purchasing green cleaning products is limited if we do not consider the actual products that are available for consumers to purchase. While using hypothetical products in sustainable consumption research has allowed for theoretical developments, these theories must now be explored in relation to real, existing products. While theory would suggest that such concepts would hold across hypothetical and real products, the current research suggests that reality is inevitably messier than a highly controlled experimental environment. The results of this research were not always in line with experimental hypotheses; it is argued that this is partly a result of the use of real products over hypotheticals. In turn, this it provides a more optimistic outlook for the future of green cleaning products. Both the laboratory and survey study suggest there are no perceived quality differences between green and conventional cleaning products. This research would suggest that consumers do not perceive green cleaning products unfavourably, potentially removing a barrier to purchase without any intervention.

The most important strength of the research is that each of the studies focused on real, existing products. This is in contrast with previous research into the sustainability liability, which uses hypothetical products in order to exert greater experimental control (Lin and Chang, 2012; Luchs et al., 2010; Mai et al., 2019). Much of the research into the sustainability liability focuses on using the same product as both the conventional and green option and manipulating the differences between them; e.g. labelling the same product as “green” in one instance and “strong” in the other. Luchs et al. (2010) create hypothetical brands of baby shampoo, car shampoo, car tyres and hand sanitizer in order to explore the theoretical basis to the sustainability liability. They do pretend to use real brands of laundry detergent familiar to their participants in one study, but in reality use a different, third brand of product for both the green and conventional product. Lin and Chang (2012) use a similar method for mouthwash, hand sanitizer and glass cleaner.
Such an approach has its merits; it allows the researcher complete control over the products. If the products are hypothetical, or identical, then they are exactly the same on every variable apart from environmental attributes. This thus ensures that participants are basing their perceptions purely on whether a product is advertised as green or not. It also ensures that each product is novel, thus meaning participants are not basing their perceptions off of prior experience with the product or preconceived judgements of the brand. Using hypothetical or identical products therefore allows for a greater theoretical understanding of the constructs at work.

However, consumer purchase decisions do not take place in a vacuum and to ignore the context of such decisions is likely to limit the applicability of such research to real life. In reality, there will be real differences between products and consumers will be familiar with some brands and unfamiliar with others. Consumers will have preconceived notions of ‘good’ and ‘bad’ brands. Products do not exist solely as ‘green’ and ‘not-green’ as they do in academic studies; green products may advertise a range of other benefits as well as their environmental ones. Otherwise conventional products may come in recycled packaging, for example, and advertise this. A myriad of variables are likely to influence consumer purchase decisions, and we must understand each of these and how they interact in order to understand sustainable consumption. If we wish to encourage consumers to purchase sustainably, it follows that research should focus on the actual products consumers have to choose between. By doing so, this research provides a key contribution to knowledge, as it is the first of its kind to explore real products. It therefore follows that the results from this research will be dissimilar to that of previous research. While previous research finds evidence for perceived negative quality perceptions in hypothetical products (Lin and Chang, 2012; Luchs et al., 2010; Zhu et al., 2012), this research finds that these negative quality perceptions do not exist for real green cleaning products.

Following on from this, the sustainability liability is based on the assumption that consumers value strength in a cleaning product, and Luchs et al. (2010) do demonstrate this in their research. However, what if this isn’t always true? Martens and Scott (2005) describe the conflict domestic practitioners face between the risk posed by infectious diseases and the risk posed by harmful chemicals in cleaning products. Strength in a cleaning product may also suggest strong, harsh chemicals. In modern Western society, the threat posed by infectious diseases often seems negligible. In the context of the sustainability liability, this could be reflected by a preference for green cleaning products as the risks from the perceived harsh chemicals in cleaning products seems greater than the risk posed by infectious diseases. Thus, more consumers may be attracted to green cleaning products as a way to strike the correct balance between the two distinct threats to health. This could explain why little evidence for the sustainability liability was found in the current research.

6.3.2. Contributions to consumer perceptions of chemicals in green products

Chapter 3 suggests that green and conventional cleaning products are similar in terms of their potential harm to human health. However, the survey-based study indicates some form of relationship between green cleaning products and perceptions of health. Overall the green product was considered less harmful to health than the conventional product when participants could correctly identify the products. This supports previous research by Bearth et al. (2017), who found that green cleaning products were rated as less harmful to health than conventional cleaning products. Furthermore, in the current research this was especially true for participants who scored highly on the New Environmental Paradigm and thus held strong pro-environmental attitudes. However, this relationship did not extend to the chemicals contained within the products; a chemical was not viewed as less harmful when contained in a green product than when in a conventional cleaning product. It therefore appears that consumers make some links between ‘green’ and ‘healthy’, but as yet this relationship is poorly understood. If participants did not view the chemicals as less harmful to health in a green product but largely viewed the green products as less harmful to health than conventional products, what is it about the products that they perceive to be less harmful?

Research suggests that laypeoples’ knowledge and perceptions around chemicals are limited (Bearth et al., 2019). Did participants (incorrectly) believe that if a product were environmentally friendly then it wouldn’t contain any chemicals at all? Thus, the interaction between green products, health and chemicals warrants further exploration. The survey only asked questions about three of the ingredients; it could thus be possible that while participants may not have perceived the ingredients in question as less harmful to health, they may have believed the other ingredients in the product to be less harmful to health. Alternatively, participants may have (incorrectly) thought that if a product were green it would not contain any chemicals at all. The word ‘chemical’ is often loaded to laypeople; synthetic chemicals are perceived as scary and unsafe (Saleh et al., 2019). Laypeople often do not realise that chemicals are necessary in everyday goods. Many people believe green products either are, or should be, ‘chemical-free’ (Siegrist and Bearth, 2019).

Siegrist and Bearth (2019, p1071) go on to state “it only requires the presence of a small amount of a substance that is seen to be unnatural – and thus associated with negative outcomes – to have a significant effect on perceived naturalness or perceived risk”. Thus, in this case it could be that the participants acknowledged the presence of a synthetic chemical and perceived it to be unnatural, and therefore riskier, despite the fact that it was contained in a green cleaning product. This may also have the potential to explain why a number of participants did not correctly identify the green product as being advertised as green.

6.3.3. Wider theoretical contributions

The current research has largely focused on the sustainability liability, but the results in general can provide some perspective on other theories. The research in Chapter 4 provides a closer and more realistic view of consumer behaviour than much of the previous research through observing consumers interacting with green and conventional products. In this regard, little evidence for the attitude-behaviour gap was found. When participants were aware of what products they were using, those who had indicated that environmental qualities were important to them in a product largely selected a green product as their reward. This shows consumers acting in line with their stated attitudes. However, it cannot be ignored that due to the overt nature of the observation, this could also be the result of social desirability.

While not the main focus of the research, the research in Chapter 5 provides some evidence for the benefits of information provision approaches. In this study, participants were provided with all of the information that would be available to them at the point of purchase. When asked to consider how useful they had found the provided information, participants were split relatively evenly, with more leaning towards it being useful than not useful (Figure 40). Few participants indicated that the information was not useful at all, suggesting that many of them did find it helpful as a basis for their decisions. 46% of the participants indicated that the information was quite or highly useful by scoring it a 6 or 7 on a 1-7 scale. Thus, this could suggest that providing consumers with product information related to safety and usage may aid with informed decision making. However, an important caveat to this is that the format of the survey meant that participants had to engage with the product information in a way that is unrepresentative of the purchase environment. While all of the information included in the survey is available at the point of purchase, it is located on the back of the bottle. Thus, consumers would have to pick up the product and rotate it in order to access this information. None of the participants in the observational study in Chapter 4 carried out this behaviour.

The current research does indicate that holding pro-environmental attitudes may influence behaviour and perceptions surrounding green cleaning products. Self-identified green consumers reported willingness to pay more for green cleaning products in Chapter 4 than participants who did not indicate a preference for green products. In Chapter 5, when participants could correctly identify products as green, participants with stronger environmental attitudes responded differently to green products than those without environmental attitudes. However, due to the limitations outlined in Section 2.1.2, the current research makes no attempt to profile these consumers demographically.

6.3.4. Contributions to methodology

The research in Chapter 3 was the first of its kind to link multiple sources of publicly available data into one concise dataset, and then attempt to use this as a point of comparison between green and conventional products. The comparisons are at this point in time relatively crude, however this is due to the limitations of the available data. Product ingredient information varies between manufacturers, and the concentration of each ingredient in the product is not released to the public. Until the quality of publicly available data increases, further and more detailed comparisons will remain unable to be carried out. Thus, the current research provides an initial starting point for these kinds of comparisons from which future research can be based upon.

The current research also highlights the difficulty of combining such data and brings to light the fact that while some information may be out there, consumers are unlikely to use it. This questions the relevance of legislation to everyday life, and calls for further research to identify how useful such information actually is. The research in Chapter 5 did attempt to explore this by combining product advertisement information with ingredient and health information taken from this dataset and asking participants how useful they believed the information was for answering the survey questions. However, it must be noted that this was a small aside question as part of a larger piece of research. Further research should be dedicated entirely towards identifying if and how consumers use the information available to them and how else the information could be provided to aid with consumer decision-making.

The current research contributes a novel way of exploring sustainable consumption that thus provides novel results. It is argued that further research into sustainable consumption needs to follow suit and focus on real life applicability over theoretical development. This research shows that using real products yields different results than research using hypothetical products. Why then, does much of the research that theory is based upon focus on hypothetical products? Research with hypothetical products is far simpler than research with real products. Hypothetical products allow for high levels of experimental control and manipulation; if the researcher designs the products then the differences between each product are carefully controlled. Any differences in perceptions of the products can be easily attributed to differences across these carefully manipulated variables, which in turn provide convincing evidence for theoretical constructs.

However, the current research demonstrates the limited applicability of such constructs to real products and therefore real consumption decisions. Using real products is difficult and it is unsurprising that until now, research using them was non-existent. Differences between products are not always clear. Boundaries between green and conventional products are often blurred. Products may be inferior in one attribute but superior in others. This can be challenging and yield results that are somewhat messy and difficult to interpret. The current research provides novel methodology allowing for the inclusion of real cleaning products in sustainable consumption research. This is found in Chapter 4. This methodology can be repeated in future research to build upon our knowledge of cleaning product perceptions. It can also be modified to further explore different facets of these perceptions. For example, it is possible that results might differ depending on whether consumers are fearful of chemicals or of infectious disease (Section 6.5). The lab-based study could be repeated, but prior to using the products the participants could be split into three groups. One group could be provided with some information about the spread of infectious disease and another group could be provided with information that would prime them about the risks posed by chemicals in cleaning products. The third group would receive no priming information and act as a control. Such research would explore whether perceptions of green cleaning products change depending on whether an individual is concerned about infectious diseases or by the chemicals contained within products. Thus, the current research provides a methodology that can be adapted to different research that will further our understanding of the sustainability liability.

On a wider level, this research also outlines guiding methodological principles that can be applied across product categories when exploring sustainable consumption. Firstly, real products should always be selected for research over hypothetical products where possible. If this is not possible, any results found using hypothetical products must be replicated using real products before bold theoretical conclusions are drawn. Secondly, the inclusion of real products will always involve a compromise between real life applicability and experimental control. Striking the correct balance between these is both difficult yet fundamental to the research. The research should aim to reduce the messiness of real-life without completely excluding it. Experimental control should be sought after but not at the expense of real-life applicability. Thirdly, researchers should use a combination of methods to explore perceptions of real products. Much of the research into consumer perceptions of green products is based on online surveys. Online surveys undoubtedly have their place in research – after all, this research has utilised them – but different results may be found at different levels of product interaction. It is important to explore how product perceptions may differ or persist at different stages of the consumption process.

6.3.5. Implications for marketing

This research clearly highlighted the difficulties participants found in differentiating between green and conventional products. Chapter 5 suggests that nearly a third of participants perceived a conventional cleaning product to be advertised as green, and a quarter perceived a green cleaning product to be advertised as conventional. This is a higher manipulation rate error than other previous research (Luchs et al., 2010). It is possible that this is a result of the use of real over hypothetical products; green products may not be as clearly differentiated in reality than they are in experimental research. This has clear implications for marketing; if consumers struggle to identify green products, this will create a further unnecessary barrier towards purchasing them. Thus, future marketing of green cleaning products needs to identify where these difficulties in differentiation lie before clearly addressing them.

The research focused on the use of real products over hypotheticals. Real products differ on a number of variables and such direct comparisons are tricky. By using real products, the current research found that for the most part, green and conventional products are very similar. Chapter 3 explored differences in ingredient toxicity between green and conventional cleaning products and found no significant differences. Chapters 4 and 5 then explored perceptions of product efficacy and found that green and conventional cleaning products were believed to perform similarly. If the products are, for all intents and purposes, exactly the same, then differences between them are largely to be created and emphasised via peripheral attributes and marketing and then reinforced through consumer perceptions. Each product will differ in relation to aesthetics, scent, strength information provided, packaging and advertising materials. Any of these factors could – and are likely – to influence product perceptions. Future research needs to explore the influence of these factors on product perceptions and preferences in the context of the sustainability liability. Physical product qualities such as aesthetics, scent and colour all play a role in perceptions of a product, as do the environmental attributes of a product. Furthermore, the context in which the product is considered or used may also influence and change the way in which consumers perceive it. Future research needs to identify how these factors interact together and how they influence product choice.

The role that scent plays in cleaning product perceptions requires further attention. The current research did not attempt to specifically examine how participants would perceive products based on scent, but it was frequently cited as a reason for selecting a green product in Chapter 4. The role of scent is multifaceted. Firstly, the results from Chapter 3 identified that fragrances are often the source of any ill health effects that may come from multi-purpose cleaning products, such as skin irritation, respiratory irritation or allergic reactions. Secondly, cleaning products do not have much to differentiate themselves on. The results of surface cleaning are largely invisible as pathogens are invisible to the naked eye. Most cleaning products will remove visible soil and therefore most products will perform a cleaning task to a satisfactory level. This is supported by Chapter 4, which finds that there were no differences across products in perceived product efficacy unless the participant was a self-identified green consumer. In both Chapters 4 and 5, around 30% of participants identified scent as an important quality in a cleaning product.

Thus, scent may be one of the only ways in which different products can distinguish themselves from others. In the absence of any other differentiating information at the point of purchase, consumers may select a product entirely based upon which scent sounds most appealing to them. Scent was a widely cited reason for product choice in Chapter 4. Thirdly, scent may also inadvertently signal perceived information about other product qualities to consumers. For example, a participant in the lab-based study cited a green product as smelling ‘less chemically’ than others. This product was scented with lavender; many of the conventional products had a more citrus-based scent. This may have been a point of differentiation for consumers: lavender fits more into the perception of ‘natural’ than citrus does. Another participant misidentified a conventional cleaning product as a green one due to its lack of scent. This suggests that consumers may use scent as a way to deduce information about other product qualities. If a product’s environmental status may influence perceptions of quality (Luchs et al., 2010), then a product's scent may influence perceptions of sustainability. However, this was not the focus of the current research and as such requires further attention in the future.

Similarly, the role of aesthetics in product perceptions also warrants further consideration. Luchs et al. (2012) note that superior aesthetics may defend green products from the negative effects of the sustainability liability. However, so far the research into this has focused on items such as mobile phones. Cleaning products are significantly less expensive, purchased more frequently and perform vastly different roles than mobile phones. As such, it is difficult to assess whether this effect holds true for cleaning products. The increased preference for the Method product in the lab-based study may support this; many of the participants who selected the Method product cited superior aesthetics and packaging. However, the study did not aim or attempt to explore the role of aesthetics on product perceptions and preferences, so participants were not asked to rate the product in terms of appearance. As such, from the current research it is impossible to empirically conclude whether a green cleaning product being perceived as aesthetically superior mitigated any negative perceptions that were a result of it's environmental status. Future research can address this in a number of ways.

Firstly, it is important to understand what is meant by 'superior aesthetics' for a cleaning product. This could be established using focus groups where different products are considered and discussed; a wider scale survey asking participants to rate these products in terms of aesthetic appeal could then be used to corroborate the results. Secondly, we need to explore whether negative quality perceptions of green cleaning products exist prior to product usage, and whether superior aesthetics negate this effect. This could be achieved through a survey-based study that asked participants how aesthetically appealing they found different products, and how effective they believed each product would be at cleaning. If superior aesthetics are found to improve quality perceptions of green products, this could have important implications. Green cleaning products are largely more expensive than their conventional counterparts, and this is often cited as a barrier towards purchasing them. However, if manufacturers of green cleaning products ensured that their products were aesthetically superior to conventional cleaning products, this could lead to green cleaning products being seen as both more effective at cleaning and deserving of their higher price tag. Effectively, this could reduce the influence of two separate barriers towards purchasing green cleaning products.

Another point to consider is that conventional cleaning product brands are starting to produce their own ‘eco-friendly’ options. Would green products be perceived differently depending on whom they are manufactured by? For example, Cif and Dettol are now selling concentrated refill pouches for their most popular product lines. This means that consumers would initially purchase the bottled product, and then when this runs out they then purchase the refill pouch. They would empty the pouch into their empty bottle and dilute with water. While these products offer no formulaic change, the refill pouches are advertised as containing significantly less plastic than if a consumer simply repurchased the bottled version of the product time and time again. It is also likely that these brands may create their own specific green cleaning product lines in the future. It would be interesting to explore what the perceptions of these products would be. On one hand, consumers may see these as a way to bridge the desire for both environmental and functional performance. It is the same product that they know and trust, but delivered in an environmentally superior manner. On the other hand, consumers may be wary of these products due to fears of greenwashing. Conventional product manufacturers have appeared unconcerned about their environmental impacts until the recent focus on environmental issues in the media and wider society. It is possible consumers may view any green products produced by these brands critically, believing that any larger scale brands are simply looking to cash in on a growing market. Future research must explore this.

6.3.6. Implications for business and policy

This research has highlighted the need for producers of green cleaning products to be more transparent regarding how and why their products are environmentally preferable. The study in Chapter 3 compared the ingredients of green and conventional cleaning products in terms of their health and environmental impacts. Surprisingly few differences were found between the two product types. A more cynical author could accuse these companies of greenwashing. However, there are many different factors that determine a product's environmental impact and formulation is just one of these. Nevertheless, green companies must do a better job of explaining the ways in which their products have a reduced impact on the environment in order to gain and retain consumer trust. They should avoid vague terminology and clearly state the environmental benefits of their product, as well as seeking third party certification. This may also help with consumer differentiation between green and conventional products. Furthermore, producers of both green and conventional products also must be transparent about the ingredients contained in their products beyond the legal necessities.

In terms of policy, the current research has demonstrated that legislation surrounding ingredient declaration may not go far enough. Under current legislation, ingredient information is difficult to access, link together and understand. While the disclosure of ingredients in consumer chemical goods is improving, more must be done to help with consumer understanding of this information. As well as requiring ingredients to be disclosed, information should also be provided about what each ingredients' role is within a product and what implications it may have for human health or the environment. This information is available, but from multiple sources that must be painstakingly interpreted and pieced together. While unlikely, a requirement to disclose ingredient concentrations would greatly aid with the ability to compare the environmental and health impacts between products. This in turn could create a comprehensive consumer decision-making aid by highlighting the least harmful products across the different hazard criteria.

6.3.7. Ethical implications

The results of this research also pose an interesting ethical dilemma. On one hand, the research has indicated that green cleaning products are no different to conventional products in terms of their risks to health. On the other hand, research has indicated this may be one of the only ways through which consumers positively differentiate and perceive green cleaning products. While formulation wise green cleaning products were not found to be environmentally superior to conventional products, it is likely that they are environmentally superior in other ways that the study in Chapter 3 could not measure. Thus, is it best ethical practice to inform consumers that green cleaning products are not less harmful to health than conventional cleaning products, knowing that this is likely to reduce their overall consumption? Or do we allow customers to continue their belief in this misconception, allowing for greater consumption and therefore potentially more widespread environmental benefits?

6.4. LIMITATIONS

A potential limitation of the current research is the soft definition of green product that was adopted. For the purpose of the research, any product that made reference to the environment was included as a green cleaning product. Other research into sustainable consumption will often require more stringent criteria to be met – for example, the presence of specific ecolabels or certifications. By including any product that self-refers to itself as an environmentally preferable product, the current research risked including products that have no real environmental benefit as green products. However, the current research was first and foremost an exploration of consumer perceptions of green products. The majority of consumers will not have in depth knowledge surrounding the plethora of different ecolabels available and their certification criteria. The majority of consumers will instead see reference to the environment – for example, a product called Ecozone, or by labelling itself as ‘non-toxic’ or ‘plant-based’ etc – and assume that the product is a green option in the choice set. Indeed, on supermarket websites, the products included in the research are the same products included in the ‘eco-friendly’ category. The aim of the research was always to approach it from the perspective of the everyday consumer. It is argued that this is achieved in part due to the broad inclusion criteria.

Similarly, a further limitation is that the research does not include an objective measure of cleaning effectiveness. The lab-based study did not measure concentrations of bacteria or viruses on the surface before and after cleaning. Perceived cleaning efficacy was instead used as a dependent variable across the two studies that attempted to measure product effectiveness. In both of these studies, participants were asked to indicate how effective that they thought the product either was or would be at cleaning in the home. However, as Goodyear et al. (2015) note, microbes, bacteria and pathogens are invisible to the naked eye. Thus, the research participants would not be able to provide an informed judgement of product efficacy. They may have perceived a product to perform exceptionally well, when in reality the product had left traces of bacteria or pathogens on the cleaned surface. While previous research suggests that consumers have negative perceptions of green cleaning products, it is unclear whether these perceptions are real or imagined. The current research can provide no further answer to this question. However, consumers would also face this dilemma when cleaning outside of an experimental setting. When cleaning in the home, individuals do not know how effective they have been in eradicating pathogens and instead have to rely on a certain visual and at times olfactory threshold that symbolises the concept of ‘clean’ (Martens and Scott, 2005). By asking participants to indicate how effective they believed the product had been at cleaning, the researchers were asking the same questions that individuals would ask themselves when cleaning at home.

While using real products is a step in the right direction for research into green cleaning products, it was largely beyond the scope of the current research to replicate a true purchasing context. One study did attempt to take into account product selection, and found one of the green brands of cleaning products to be unanimously favoured. However, it cannot be ignored that the scenario in which participants had to make this choice was largely artificial. Participants had the chance to interact with six different cleaning products and use them on a variety of stains before selecting their favoured product free of charge. In real world purchase decisions, consumers have to select from a variety of products that for the majority of them they will have no prior knowledge as to how the product performs. Each of the products is likely to differ in terms of price. This decision is one of many that they must make while shopping, and they have to pay for the products with their own money. Thus, one avenue for future research is to observe consumers as they make their product selections – both in physical stores and online. Observational studies do exist (Hoyer et al, 1984; Dickson and Sawyer, 1990; Leong, 1993), but many are outdated, focus on multiple product categories and do not differentiate between green and conventional products. Observing consumers selecting between cleaning products may yield important contextual information to which future research can be grounded. What do consumers look at when selecting a cleaning product? How long do they look at it for? How many items do they consider and how long do they spend considering them? Are green products considered – and how often? Does the information search process differ between green and conventional products? Do these answers differ between physical and online shopping? This research provided an exploration of differences between real green and conventional products. The next step for research is to explore these differences in real consumption environments.

6.5. FUTURE RESEARCH

First and foremost, the difficulties faced by participants in differentiating between green and conventional products have huge implications for both sustainable consumption itself and research into it. 38.6% of participants believed a conventional product to be advertised as green. 24.3% of participants believed a green advertised product to be conventional. If participants in research struggle to differentiate between green and conventional products, how can we expect consumers to be able to do this on a wider scale? If consumers do not know which products are environmentally preferable, how can we expect them to purchase these? It is essential that to understand where participants are struggling; what is it about the green product that made them believe it was not advertised as an environmentally friendly product? What is it about the conventional product that led participants to perceive it as a green product? Once this is understood, future research then needs to address the best ways in which these products can be clearly differentiated.

While far beyond the scope of this research, homemade cleaning products require closer scientific examination. A barrier towards purchasing green cleaning products is often their price. Furthermore, many individuals are wary of ‘chemicals’ in cleaning products, often believing them to be harsh and dangerous. It is therefore possible that to fulfil the need for cheap and (perceived) safe cleaning products, individuals are making their own from ingredients such as vinegar, baking powder, lemon juice and essential oils. At the time of writing, a Google search of “homemade cleaning products” yields 3.65 billion results. The same search on Amazon results in 149 books dedicated to homemade cleaning product recipes. While finding definitive statistics on how many people are turning to homemade cleaning products is tricky, it does appear that some people at least are cleaning their homes with products they have made themselves. It is not possible to provide a thorough understanding of household cleaning products without at least paying some attention to homemade products.

Research into such products is limited at best and at present it is difficult to conclude whether such products are effective or not. Greatorex et al. (2010) suggest that a solution of 10% strength malt vinegar is sufficient for disinfection. Goodyear et al. (2015) indicate that DIY solutions generally do not meet sufficient levels of cleaning effectiveness, and that storing a DIY solution for 24 hours reduces it effectiveness by 50%. Future research needs to explore a) the effectiveness of homemade solutions at cleaning and b) consumer perceptions of homemade cleaning solutions. A study similar to the one in Chapter 4 could be repeated but including a popular homemade solution as one of the test products. If homemade cleaning products are proven to be effective at cleaning, and consumers perceive them favourably, these could potentially provide a solution for individuals who wish to purchase green products but are prevented from doing so due to budgetary constraints. However, if they are not proven to be effective, this needs to be communicated clearly and effectively so as not to pose a threat to human health via poor home hygiene.

The current research demonstrates that while the products themselves are largely similar, consumer perceptions of green products may not remain stable from hypothetical to real products. Another factor to consider is whether consumer perceptions and preferences are stable across time and contexts. While the products may be largely the same, it is possible that the context in which they are considered will influence the way that they are perceived. Climate change, environmentalism and the importance of individual action are gaining traction within the media. Groups like Extinction Rebellion, the student climate strikes and individuals such as Greta Thunberg are bringing climate change to more mainstream attention. The documentary *Blue Planet II* is viewed as influential in bringing the issue of single use plastic to public consideration (Jones et al., 2019; Schnurr et al., 2018). Thus, the wider context surrounding sustainable consumption is changing. People who may not have considered their role in protecting the environment may now be doing so.

As a result, more and more companies are discussing their commitments to sustainability, and are creating products that bear the environment in mind. For example, both Dettol and Cif have recently released ‘eco’ refill pouches for their most popular products, meaning consumers only have to purchase the original bottle once. Sainsbury’s are trialling Ecover refilling stations within certain stores, which would allow consumers to reuse the original bottle almost infinitely, only replacing the liquid it contained. The current research was carried out largely before any of these factors took place. It is possible that if the research were replicated, more participants would have indicated pro-environmental preferences, and/or more favourable perceptions of green cleaning products.

At the time of writing (but after the research took place), coronavirus (COVID-19) is spreading rapidly. This has led to consumers stockpiling products such as hand sanitizer and antibacterial cleaning sprays in a bid to avoid contracting the disease (*The Guardian*, 2020; *BBC News* 2020). While an extreme example, this reframes the conflict between disease and chemical risk in favour of infectious diseases. Thus, it is possible that if the research were to be replicated in the current societal context, the results may not be so favourable towards green cleaning products. This poses some interesting questions. Would preferences for cleaning products (either conventional or green) change dependent on whether an individual is anxious of chemicals or of infectious disease? If these anxieties change over time, would product preferences also change? This could be tested in an experimental setting by manipulating the context in which the participants felt the study to take place in via the use of priming information.

6.6. SUMMARY

Green cleaning products were one of the first sustainable alternatives to hit the market. They were not well received; largely viewed as being both costly and ineffective. It is possible that this bias is one that has permeated the minds of academics and consumers alike. However, having been one of the earliest green markets, green cleaning products have had more time than most categories to catch up in terms of efficacy and consumer perceptions. The current research is, quite possibly, an indication that the tide is turning for green cleaning products. As a relatively mature green market, green cleaning products have been afforded the chance to catch up to conventional products in terms of consumer perceptions.

The current research finds that while hypothetical products may be perceived differently in terms of effectiveness, there are no differences in perceived product efficacy between green and conventional cleaning products. This remains true across two studies; one of which where consumers were asked to rate the product without using it, and one where they were asked to rate the product after usage. This provides convincing evidence that green cleaning products display no differences in perceived effectiveness to conventional cleaning products. Now, consumers may simply just consider green cleaning products as another product in the choice set as opposed to a separate yet lateral category entirely. Thus, rather than using a product's greenness as a heuristic in itself, consumers are applying the same heuristics they use for deciding between products across conventional and green products alike. To consider this in the wider context of sustainable consumption in general, it is likely that for product categories where gentleness is valued, green products will be on a similar footing perception wise from the outset. For product categories where strength is valued, it is possible that there will be initial negative quality connotations attached to green products. The current research has demonstrated, however, that these can and will be overcome in time.

The current research has provided a general overview of green cleaning products. It has explored the differences between conventional and green cleaning products in terms of formula, performance and perceptions. It has also explored consumer perceptions of chemicals, and the relationship between these perceptions and a product's environmental status. Most importantly, each piece of the current research has been based on real and existing products as opposed to hypotheticals. By doing so, it has revealed the limitations of the theoretical foundation it was based upon and highlighted the importance of grounding research in a real-life context. As a result of this, the results of the current research pose as many questions as they answer, providing ample opportunities for future research.

7. Conclusions

This thesis aimed to explore different consumer perceptions of green household surface cleaning products. More specifically speaking, the research aimed to address the following four questions:

1. Are there differences in the composition of green and conventional cleaning products? If so, do these differences have implications for health and the environment?

2. Does a product's environmental status influence how the product is perceived in terms of its effectiveness?

3. Does a product's environmental status influence how the product is perceived in terms of its safety?

4. Does a product's environmental status influence the way in which its ingredients are perceived?

By exploring and answering these questions, the research contained in this thesis has combined previously separate streams of literature and added to our understanding of sustainable consumption regarding household surface cleaning products. It has also contributed methodology that can and should be repeated in future research. It finds that many ingredients overlap between green and conventional cleaning products and their impact on human health and the environment is much the same. Consumers struggle to identify green cleaning products, but those who can distinguish between green and conventional products believe green products to be less harmful than their conventional counterparts. However, they believe the ingredients contained in green and conventional cleaning products to pose a similar level of risk to human health and the environment. Most importantly, there are no differences in perceived effectiveness between green and conventional cleaning products; a surprising yet welcome finding.

7.1. Reflections

7.1.1. Cleaning product formulation

The work in this thesis shows that based on their formulas, green and conventional cleaning products pose similar risks to human health and to the environment. This disproves the popular belief that green cleaning products are less harmful to human health than conventional cleaning products. It therefore displays the need for greater educational campaigns aimed at dispelling the myth that green cleaning products pose little risk to human health to ensure safe usage by consumers. Furthermore, by finding no significant differences between green and conventional products in terms of potential harm to the environment, it also raises questions as to how green these products really are.

7.1.2. Product efficacy perceptions

This thesis explored the sustainability liability – that is, the belief that green products in certain product categories are at a disadvantage due to perceptions of their strength – with regards to actual products as opposed to hypotheticals. It is the first study of its kind to truly do so and as such produced novel results. Cleaning products are frequently cited as a product category whereby strength is highly valued, and therefore green alternatives should be perceived particularly unfavourably in comparison to conventional products (Lin and Chang, 2012; Luchs et al., 2010). This thesis challenges these assumptions in two ways. Firstly, while strength may be valued for cleaning products, both the experimental study and the online survey study showed that environmentally friendly attributes are similarly important to consumers. Secondly, both studies find that there are no differences between green and conventional products in terms of their perceived effectiveness. This highlights the importance of basing research into sustainable consumption on actual products rather than hypothetical ones. It also provides a slither of hope for the future of green cleaning products; negative quality perceptions of these products are not as widespread as we were led to believe. While they may still be outcompeted in popularity by conventional alternatives, this research shows that there is at least one less barrier towards their purchase than was previously thought.

This thesis also combined two previously separate streams of literature; that into perceptions of product efficacy and that into perceptions of product safety. Luchs et al. (2010) suggest that consumers would perceive green cleaning products as less effective because they are believed to be weaker than conventional products. Bearth et al. (2017) demonstrate that consumers believe green cleaning products to be less harmful to health than conventional products. It appears obvious for there to be some form of relationship between these two streams of research, but until now this potential relationship remained unexplored. By explicitly asking participants about perceived product efficacy and perceived harm to human health, this research was the first of its kind to combine these two ideas and assess whether there was any relationship between the two. As no differences between perceived product efficacy were found between green and conventional products, there could be no relationship between perceived product efficacy and perceived harm to human health.

The work in this thesis adds to the wider literature by suggesting that negative quality perceptions are not a barrier towards the purchase of green cleaning products. Negative quality perceptions of green products are widely cited in the literature; Gleim and Lawson (2014) find that a third of consumers cited poor quality as a barrier to purchasing green products. Carrington et al. (2014) note that consumers believe that by selecting a green product they are sacrificing on product quality. Chang (2011) finds scepticism about product quality to be a significant predictor of negative attitudes towards buying green products. These negative attitudes are supposed to be greater barriers towards purchase for products with functional attributes. Tseng and Hung (2013) suggest that consumers gain greater product satisfaction through functional benefits than environmental ones; Joshi and Rahman (2015) further this by highlighting that even consumers with pro-environmental attitudes will always value functional attributes over environmental ones. Luchs and Kumar (2017) note that consumers who select a green product over a conventional one will experience distress as their functional needs are compromised. Cleaning products have been widely cited as an example of a functional product whereby consumers highly value strength within it, and as such should perceive a green cleaning product to be inferior in quality (Bodur et al., 2015; Lin and Chang, 2012; Luchs et al., 2010).

The current research finds no evidence for negative quality perceptions of existing green cleaning products across two separate studies; one whereby participants were asked to rate product efficacy after using and interacting with the product, and another whereby they had no physical interaction with the product at all. This provides compelling evidence to suggest that consumers perceive green cleaning products as of similar quality to conventional cleaning products. It cannot be argued that negative quality perceptions of some green products don't exist at all. However, the current research argues that for green cleaning products, negative quality perceptions do not exist and therefore cannot be a barrier towards their purchase. It therefore highlights the importance of challenging assumptions within research into sustainable consumption. Rather than relying on literature that suggests negative quality perceptions will exist for a certain product category, this research emphasises the importance of testing this for each product category of interest.

7.1.3. Product safety perceptions

It was found that consumers perceived green products overall to be less harmful to human health than conventional products, but only if they could correctly identify that the product was advertised as green. This supports the research of Bearth et al. (2017) and furthers it by suggesting an extra step in the relationship between a product's environmental status and perceptions of harm to human health. A product being advertised as green is not enough; participants must first correctly identify that the product is, in fact, a green product. While this may seem like common sense, it is important in two ways. Firstly, it highlights that the differences in perceptions of harm are the result of the products environmental status, and not an unknown variable. Secondly, it displays the difficulties that consumers have in distinguishing between green and conventional products and the implications this can have. Arguably, this could be the most important conclusion of this research.

7.1.4. Ingredient perceptions

This thesis also furthered the research into the relationship between a product’s environmental status and its perceived harm to human health by exploring it at an ingredient as well as product level. By asking about perceptions of ingredients harm to health across green and conventional products, it was the first of its kind to assess where the relationship between environmental status and perceived harm to health lies. However, no firm evidence was found to suggest that consumers perceive the ingredients contained in green products to be less harmful to health than the ingredients contained in conventional products. This suggests that while there is some relationship between a product’s environmental status and its perceived harm to health, the nature of this relationship is still unknown. It also reflects the results of the first study in this thesis, which showed that formulation wise green and conventional products are similar in terms of the risks they pose to human health and the environment.

7.2. Limitations

There are some limitations to the current research that require acknowledgement. This research approached the research questions from the perspective of the everyday consumer; an individual who is unlikely to have extensive knowledge of sustainability and sustainability related issues. As a result, a somewhat soft definition of green product was adopted throughout the research. Other research into sustainable consumption will adopt more stringent criteria when identifying green products, such as only including products that have received a particular third party certification. Had the current research adopted this approach, different results may have been found. However, it is argued that for the majority of consumers, a product making reference to the environment in any shape or form is likely to be enough to categorise the product as green. While the research in Chapter 5 highlighted that consumers do face difficulties differentiating between green and conventional products, 75% of the participants did identify a green advertised product as green, regardless of any certifications. Thus, the definition of green products utilised in this research was justified.

A further limitation is that the current research did not provide greater insight into the objective effectiveness of green and conventional cleaning products, as there was no measure of surface pathogens before and after cleaning. While the results of the research in Chapter 4 suggest that there are no perceived differences in effectiveness between green and conventional cleaning products, it does remain possible that there could be differences between products in their objective cleaning effectiveness.

Finally, while the research finds differences in participants' willingness to pay for green products, it must be acknowledged that there is a disparity between how much consumers indicate they would be willing to pay in a research environment and how much they would actually pay in a real purchasing environment. It was not possible to ask participants to pay for a cleaning product in this research and thus the willingness to pay approach was the only feasible option to explore the perceived financial value of the products.

7.3. Future research

This research highlights the need for research into sustainable consumption to utilise more realistic methodology that is more reflective of the wider purchase and consumption environment. The research in Chapter 4 proposes a methodology that could be adapted to different products, as well as providing opportunities to look in greater depth at different factors that could affect product perceptions and purchase decisions. Through using different and more realistic methodologies, this research yielded different results to previous research. It is thus apparent that a wider range of methodologies into exploring product perceptions and purchase decisions are required.

A further conclusion to be drawn from this research is that greater nuance into how and why consumers buy green products is required within the green marketing literature. Much of this literature focuses on the green consumer and how to appeal to them across all products. This research emphasises the need to consider each product category separately in order to truly understand why people buy – or do not buy – green products. No standardized green marketing campaign will ever be truly effective, and consumers are likely to respond to different strategies across different product categories. Consumers' base levels of knowledge, perceptions, awareness of environmental issues and motivation to seek out information will differ between product categories. Furthermore, this research was conducted into cleaning products; a product category whereby there have been green alternatives since the 1980s and thus the market has had a chance to develop and mature. While there may not have been differences in perceived product efficacy in this market, it is possible that the results would be different in a younger market. Following on from this, it is important that future research into green marketing focuses less on the green consumer and instead puts greater emphasis on how to make green products attractive to all consumers.

A final conclusion to be drawn from this thesis is the importance of continuing with interdisciplinary research into sustainable consumption. The current research spanned across multiple different disciplines: sustainability science, chemistry, toxicology, psychology and marketing. This combination has allowed for unique insights into the green cleaning product market and the challenges it faces. To have approached this topic from the view of one particular discipline would have provided an incomplete picture of the area in focus. Had the research only focused on the chemistry and formulation of green cleaning products, it would have overlooked the importance of the way consumers perceive these ingredients and products. To have approached it purely from a psychology perspective would have ignored the implications that this research has for marketing, business and for the wider environment. While an interdisciplinary approach is not without its complications, and there are merits to the greater depth a mono-disciplinary approach can provide, it is imperative that future research continues to tie these streams of research together.

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9. Appendices

APPENDIX 1: PRODUCT INFORMATION

Appendix 1a: Product information (Mr Muscle)

Product Description

- Mr. Muscle All Purpose Cleaner Citrus Lime 500ml

SC Johnson A family company since 1886. Fisk Johnson

- Cleans all hard surfaces to a streak free shine
- Tough enough cleaning formula removes dirt and watermarks
- Leaves citrus lime scent
- Pack size: 500ML

Information

Ingredients

Contains <5% non-ionic surfactant; perfume.

Preparation and Usage

- DIRECTIONS: Turn nozzle to 'SPRAY' position. Spray directly onto surface with full trigger strokes. Wipe with kitchen paper or a soft dry cloth for sparkling results. When finished, turn nozzle to ‘STOP’ position and store bottle upright. Do not use on polished, painted or oiled wooden surfaces. On surfaces other than glass, mirrors, tiles and chrome, test on an inconspicuous area first. Do not mix with other cleaners. DO NOT use on electronic devices.

Warnings

- If medical advice is needed, have product container or label at hand. Keep out of reach of children.
- IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Do not breathe spray. Wash hands thoroughly after handling.
- Use only in well-ventilated areas. As with any household product avoid prolonged skin contact with this product.

Information from: https://www.tesco.com/groceries/en-GB/products/276118001, accessed 28/04/2020

Appendix 1b: Product information: Dettol

Product Description

- Anti-Bacterial Surface Cleanser
- Dettol Anti-Bacterial Surface Cleanser is proven to kill
- Bacteria
- E.coli, S.aureus, Listeria, Campylobacter, Paerughosa, MRSA, Salmonella
- Viruses
- Influenza - Type A H1N1
- Dettol Anti-Bacterial Surface Cleanser is proven to remove
- Allergens
- Pollen particles, dust mites, pet dander
- Trusted by doctors* to kill bacteria
- *Based on research carried out by IPSOS with 228 GPs, a majority of GPs questioned agreed that they 'trusted Dettol Surface Cleanser to kill bacteria'

- Suitable for: chopping boards, high chairs, changing mats, fridge, bins, kitchen sink, baths & taps, toilets seat
- If you like this product, why not also try Dettol Cleansing Surface Wipes
- www.happier-homes.com
- www.sustainable-cleaning.com
- The British allergy foundation - seal of approval
- Dettol surface cleanser provides 3x protection vs. Bacteria, flu virus and allergens
- Provide 3x protection against bacteria, the Flu Virus and allergens with Dettol Anti-Bacterial Surface Cleanser. This easy to use spray is clinically proven to kill 99.9% of bacteria including E. Coli, Rotavirus, salmonella, MRSA and the flu virus. What's more our wipes are non-bleach and non-taint, meaning they are free from harmful cleaning agents and safe to use where food is prepared. Our convenient spray will make short work of disinfecting difficult surfaces, but with lasting results. And if that wasn't enough, Dettol Cleansing Surface Wipes eliminate 90% of allergens such as pollen particles and dust mites, which is why they are recommended by Allergy UK. Dettol - tackling the dirt you can see and the germs you can't.
- To disinfect your chopping boards, high chairs, changing mats, fridges, bins, kitchen sinks, baths, taps and toilet seats, and to protect your home from bacteria and allergens first turn the red nozzle to the 'ON' position. Spray directly onto your desired surface, wipe over with a clean damp cloth and allow to dry. There is no need to rinse, all that is left to do is relax with time saved.
- Dettol are experts in hygiene, and we know what it takes to keep your family happy and healthy. We're on a Mission for Health, using all our expertise to make effective cleaning products, provide education about health & hygiene, and champion worthy causes. The Complete Clean range is just one example of our family of germ-killing products: these multi-purpose cleaners target bacteria like E.coli and Influenza to ward off everyday germs and keep your home healthy. As well as our Mould and Mildew Remover, we offer anti-bacterial wipes, multi action sprays

and floor cleaners so you can rely on Dettol's disinfection to help keep your whole home clean and hygienic.

- Dettol Anti-Bacterial Surface Cleanser
- Suitable for use on any surface
- Safe to use where food is prepared
- Leaves no harsh chemical residue
- Kills 99.9% of bacteria
- Pack size: 500ML

Information

Ingredients

Per 100g of product contains 0.07g Benzalkonium Chloride, <5% Non-Ionic Surfactants, Disinfectant, Perfume

Produce of

Made in EU

Preparation and Usage

- How to Use:
- 1. Turn red nozzle to On position.
- 2. Simply spray directly on to surface.
- 3. Wipe over with Clean damp cloth & Allow To Dry.
- 4. No need to rinse.
- 5. With electric equipment spray on to cloth before wiping.
- Not suitable for: Windows, mirrors, fabrics, painted or vanished surfaces. Do not use with detergents or other disinfectant. Avoid contact with plastic baby bottles, which can crack when steam sterilised. Do not freeze.

Warnings

- Caution: Keep out of reach of children. If swallowed: Call a poison centre or Doctor/ Physician if you feel unwell.

Return to

- Dettol™ Consumer Services:
- For help and advice, contact us:
- www.dettol.co.uk
- Reckitt Benckiser
- UK - PO Box 4044,

- Slough,
- SL1 0NS.
- 0845 769 7079
- ROI - Citywest Business Campus,
- Dublin 24.
- 01 661 7318

Net Contents

500ml ℮

Safety information

Caution: Keep out of reach of children. If swallowed: Call a poison centre or Doctor/ Physician if you feel unwell.

Information from: https://www.tesco.com/groceries/en-GB/products/255282067, accessed 28/4/2020

Appendix 1c: Product information: Ecover

Product Description

- Multi-Action Spray
- At Ecover, we have been pioneering green science for over 30 years to bring you effective, naturally-derived cleaners.
- Our plant-based and mineral ingredients work hard on surfaces to tackle grease and grime leaving no chemical residues, just a sparkling clean home.
- Ecover's pioneering, bee-inspired eco-surfactants put petrochemical ingredients to shame and clean brilliantly - we're buzzing about them.
- We use a formula which dries quickly on your surfaces so that you are not left with smears or streaks, just sparkle and shine.
- Ingredients inspired by bees
- Quick drying formula

- Tackles grease & grime
- UNEP Award
- Cruelty-Free international
- Pack size: 500ML

Information

Ingredients

<5%: Non-ionic Surfactants, Perfume, Others: Water, Alcohol Denat., Sodium Citrate, Lactic Acid

Produce of

Produced in EU

Preparation and Usage

- Usage: For use on kitchen surfaces, tables, chairs and other hard surfaces. Spray directly onto surface and wipe clean. No need to rinse.

Warnings

- CAUTION: Keep out of the reach of children.

Recycling info

Bottle. Plastic - Widely Recycled Trigger. Plastic - Check Local Recycling

Name and address

- Produced for:
- EPC N.V.,
- Industrieweg 3,
- 2390 Malle,
- Belgium.

Return to

- EPC N.V.,
- Industrieweg 3,
- 2390 Malle,
- Belgium.
- www.ecover.com
- 08451302230
- info@ecovercareline.co.uk

Net Contents

500ml e

Safety information

CAUTION: Keep out of the reach of children.

Information from: https://www.tesco.com/groceries/en-GB/products/264679276, accessed 28/04/2020

Appendix 1d: Product information: Flash

Flash Clean & Shine Crisp Lemons is the All-Purpose Spray Cleaner that offers you a universal solution for your entire home, so you don't need hundreds of cleaners under the sink! Flash multipurpose spray cleaner dissolves grease & dirt, leaving freshness & brilliant shine, so you can easily clean everyday dirt & grease such as food spillages in the kitchen, toothpaste, makeup residues, soap scum in the bathroom, leaving a fresh smell in the room.

- A universal solution for your entire home
- All Purpose Spray Cleaner
- Great Flash cleaning power
- Leaves your floor surfaces sparkling clean and smelling fresh

- Cuts grease, soap scum and dirt
- Perfect for hard, washable surfaces
- Pack size: 500ML

Information

Ingredients:

<5% Non-Ionic Surfactants, Soap, Benzisothiazolinone, Perfumes, Citral, Hexyl Cinnamal, Limonene, Linalool

Preparation and Usage

Just spray Flash cleaner on your hard surfaces and wipe with a dry or damp cloth. For Heavy soil or bacteria kill: leave the cleaning spray to act for a 3 minutes before wiping. On waxed or painted surfaces: test the surface cleaner first on a small inconspicuous area before use. Keep bottle upright.

Warnings

Causes serious eye irritation. If medical advice is needed, have product container or label at hand. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Do not breathe spray.

Return to

Procter & Gamble UK, Weybridge, Surrey, KT13 0XP, UK

0800 328 2882

Question? Give us a ring or send us a mail.

Net Contents

500 ℮

Safety information

WARNING Causes serious eye irritation. If medical advice is needed, have product container or label at hand. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Do not breathe spray.

Information from: https://www.tesco.com/groceries/en-GB/products/261537000, accessed 28/04/2020

Appendix 1e: Product information: Method

Product Description

- Non-Toxic Surface Cleaner Big Bottle French Lavender
- Certified cradletocradle Silver - designed + sourced responsibly from beginning to end to beginning again. That's good karma.
- Hello, we're method.
- We are people against dirty®. In your hand, you hold the power to join us in the good fight. The fight to make our planet, and homes, a cleaner place. We are passionate believers in the Cradle to Cradle® design philosophy, meaning that each one of our products has a past and a future. That's why we make our bottles from old bottles and our non-toxic cleaners are biodegradable. It's also why every material we use is assessed by independent scientists for environmental quality + safety for people. Because we believe that cleaning products can put the hurt on dirt without doing harm to people, creatures or the planet.

They can even smell like rainbows. It might sound like a tall order, but we're a small, passionate bunch with big ambitions.

- For shiny surfaces that smell good enough to lick.
- We help you put the hurt on the dirt.
- Grease + grime don't stand a chance against powergreen® technology. Each squirt, in all its lovely non-toxic glory, packs a powerful cleaning punch. Naturally derived, biodegradable cleaners made from corn + coconut break down dirt, so when you've finished, the only thing left is a sparkling sense of satisfaction.
- Multi-Surface
- With non-toxic plant-based powergreen technology
- Cuts grease + grime
- Certified cruelty free
- Pack size: 828ML

Information

Ingredients

What's in the Bottle: Water, <5%: Non-Ionic Surfactants (Decyl Glucoside*), Perfume (Linalool*), Sodium Gluconate*, Sodium Carbonate*, Citric Acid*, Potassium Hydroxide*, Colorant, *Denotes Plant or Mineral Origin

Produce of

Made in the EU

Preparation and Usage

- Easy to use: Spray on surface, wipe immediately.
- Stand back and admire. For use on most sealed surfaces.
- Worktops, tile, stone, wood, glass
- Psst: It's always a good idea to test in an inconspicuous place first.

Warnings

- CAUTION: AVOID CONTACT WITH EYES. IN CASE OF EYE CONTACT, FLUSH WITH WATER. IF SWALLOWED, DRINK A GLASS OF WATER AND CONTACT A DOCTOR. KEEP OUT OF REACH OF CHILDREN.

Recycling info

Pump. Recyclable

Name and address

- Made for:
- Method Products Ltd.,
- 26 York Street,
- London,
- W1U 6PZ.

Return to

- Method Products Ltd.,
- 26 York Street,
- London,
- W1U 6PZ.
- 0207 788 7904
- talkclean@methodhome.com
- methodproducts.co.uk

Net Contents

828ml ℮

Safety information

CAUTION: AVOID CONTACT WITH EYES. IN CASE OF EYE CONTACT, FLUSH WITH WATER. IF SWALLOWED, DRINK A GLASS OF WATER AND CONTACT A DOCTOR. KEEP OUT OF REACH OF CHILDREN.

Information from https://www.tesco.com/groceries/en-GB/products/267518780, accessed 28/04/2020

Appendix 1f: Product Information: Cif

- Cif Power & Shine Multi-Purpose with Antibacterial agents is a great all-round home cleaner.
- This multi-purpose spray with powerful Antibacterial agents kill 99.9% of bacteria and flu viruses (including Salmonella, MRSA, E.Coli) and effectively removes daily dirt and grime all around the home.
- Our formula is suitable for food preparation areas, but equally good in the bathroom, leaving surfaces sparkling clean with a fresh fragrance.
- You will be left with sparkling, hygienic and shiny surfaces, free of germs, all around the home.
- For a sparkling home, try also Cif Power & Shine Kitchen Spray to cut through tough grease with its orange and tangerine oils and Cif Power & Shine Bathroom Spray to quickly lift away 100% of soap scum and limescale.
- At Cif, we believe in revealing and protecting beauty for everyone to enjoy, every day. That's why for over 50 years, Cif has developed a

range of cleaning products that remove ugly dirt, without damage, providing you with beautiful results.

- How to use Cif Power and Shine:
- To achieve the best result, spray onto the surface, leave for a few seconds and wipe with a damp cloth. For stubborn stains and dirt leave for a few minutes before wiping.
- For more hints and tips for all your home cleaning needs, visit cleanipedia: https://www.cleanipedia.com
- *Eliminates bacteria like Salomella, MRSA, Ecoli and Listeria and flu viruses (H1N1)
- Cif Power & Shine Antibacterial Multi-Purpose Cleaner Spray leaves your home sparkling clean
- Our Multi-Purpose Cleaner Spray has powerful antibacterial agents to deep clean your home
- Cif Power & Shine Antibacterial Cleaner Spray kills 99% of bacteria & flu viruses*
- This Cif cleaner removes daily dirt & grime effectively
- Our all purpose cleaner leaves sparkling, hygienic and shiny surfaces, free of germs, all around your home.
- Our formula is suitable for food preparation areas and equally good in the bathroom.
- Pack size: 700ML

Information

Ingredients

Disinfectant: Benzalkonium Chloride 0.75g per 100g. <5% Nonionic surfactants, Cationic surfactants, Phosphates, Perfume

Storage

null

Produce of

United Kingdom

Warnings

- Causes serious eye irritation. Harmful to aquatic life with long lasting effects. Precautions: do not use on painted surfaces, marble or linoleum. Rinse immediately after use on plastics to avoid possible damage

- Keep out of the reach of children. Wear eye protection/face protection. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention. Avoid breathing spray. Dispose of used up container in accordance with local regulations

Name and address

- Unilever UK Ltd,
- Springfied Drive,
- Leatherhead,
- KT22 7GR.
- Unilever Ireland Ltd,
- 20 Riverwalk,

Net Contents

700 e

Safety information

Causes serious eye irritation. Harmful to aquatic life with long lasting effects. Precautions: do not use on painted surfaces, marble or linoleum. Rinse immediately after use on plastics to avoid possible damage Keep out of the reach of children. Wear eye protection/face protection. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention. Avoid breathing spray. Dispose of used up container in accordance with local regulations.

Information from https://www.tesco.com/groceries/en-GB/products/291443566, accessed 28/04/2020.

APPENDIX 2: SOIL MATERIAL

Appendix 2a: Jam

Product Description

- Strawberry jam.
- Tesco strawberry jam CLASSIC RECIPE Made with fruit harvested at its peak for a ripe, juicy flavour
- CLASSIC RECIPE Made with fruit harvested at its peak for a ripe, juicy flavour
- Pack size: 454G

INGREDIENTS**:** Glucose-Fructose Syrup, Strawberry, Sugar, Strawberry Purée, Citric Acid, Gelling Agent (Pectin), Acidity Regulator (Sodium Citrate).

Information from: https://www.tesco.com/groceries/en-GB/products/272781689

Appendix 2b: Curry sauce

Product Description

- A tomato based sauce with peppers, coconut and coriander.
- Our mouth-watering Jalfrezi Sauce is a wonderful blend of tomatoes, red & green peppers, coconut and coriander to create a delicious sauce.
- A feast for the senses every time.
- For three generations, our family has been proud to share our passion for the exciting flavours of India, sourcing and blending some of the best spices to our own secret recipe.
- Chilli rating - medium - 2
- Gluten free
- No artificial flavours, colours or preservatives
- Vegetarian
- Pack size: 450G

Ingredients

Water, Green & Red Pepper (8%), Tomato (6%), Rapeseed Oil, Onion, Ground Spices [Spices, Coriander (1%)], Sugar, Modified Maize Starch, Concentrated Tomato Purée (1.5%), Desiccated Coconut (1%), Garlic Purée, Salt, Ginger Purée, Acids (Citric Acid, Acetic Acid), Cumin Seed, Mustard Powder, Paprika Extract, Dried Coriander Leaf

Information from: https://www.tesco.com/groceries/en-GB/products/274747250

Appendix 2c: Barbecue sauce

Product Description

- Classic Barbecue Sauce.
- Delicious as a dip for your chips, a topping for your burger or a marinade for your meat. For more recipe ideas visit heinzbarbecue.co.uk
- RICH & SMOKEY.
- No artificial colours or preservatives.
- Suitable for vegetarians.
- Pack size: 480G

Ingredients:

Tomato Puree, Spirit Vinegar, Sugar, Molasses, Water, Modified Cornflour, Salt, Spices, Garlic, Thickener (Xanthan Gum), Smoke Flavouring, Natural Flavouring

Information from: https://www.tesco.com/groceries/en-GB/products/272781689

APPENDIX 3: STUDY MATERIALS

Appendix 3a: Study Questionnaire 1

1. How old are you?

   18-21 22-25 26-30 31-35 36-40 41-50 51-60 61-70 71+

2. What is your gender?

   Male Female Other

3. Choose one option that best describes your ethnic group or background.

   White British White European Mixed Background

   Asian/Asian-British Black/African/Caribbean/Black British

   Other

   If you selected "Other", please specify:

   ____

   ____

4. What is the highest level of education you have received? If you are still currently in education, take the qualification for which you are studying as your highest level of education.

   No Education Completed Primary School GCSE's or Equivalents

   A Levels or Equivalents Undergraduate Degree or Equivalent

Masters Degree   *PhD*

5. How many people live in your household including yourself?

1   *2*   *3*   *4*   *5*   *6*   *7+*

6. Are you the main person responsible for purchasing cleaning products in your household? If no, please skip to question 8.

Yes   *No*

7. If yes, how regularly do you purchase household cleaning products?

More than 1x per week   *Once a week*   *Once a fortnight*

Once a month   *Less frequently than once a month*

8. Are you the main person responsible for cleaning in your household?

Yes   *No*

9. How frequently do you use multipurpose household cleaning products?

Multiple times per day   *Daily*   *Every other day*   *Weekly*

Fortnightly   *Monthly*   *Less frequently than once a month*

10. What is most important to you when selecting a multipurpose household cleaning product? If you are not the main person responsible for purchasing household cleaning products, please answer with what would be most important to you if you were.

Price   *Quantity*   *Brand*   *Scent*   *Colour*

Sensitive Skin Ingredients   *Eco-friendly products*   *Strength*

If it is on offer *If you have used it before* *Other*

If you selected “Other”, please specify:

_

_

Of the following brands of multipurpose household cleaner products, which of these have you purchased or used in the last month? Please select all that apply.

Cif *Flash* *Dettol* *Supermarket own brand*

Mr Muscle *Astonish* *Stardrops* *Method*

Domestos *Ecover* *Cillit Bang* *Other*

If you selected “Other”, please specify:

Appendix 3b: Study questionnaire 2

Product 1

1. On a scale of 1-10 with 1 being the hardest and 10 being the easiest, how easy was this product to use?

   1 2 3 4 5 6 7 8 9 10

2. On a scale of 1-10 with 1 being the slowest and 10 being the fastest, how quickly was the cleaning task completed with this product?

   1 2 3 4 5 6 7 8 9 10

3. On a scale of 1-10 with 1 being the least efficient and 10 being the most efficient, how efficient was this product at the cleaning task?

   1 2 3 4 5 6 7 8 9 10

4. On a scale of 1-10 with 1 being the shortest and 10 being the longest, how long-lasting do you think the effects of this product would be?

   1 2 3 4 5 6 7 8 9 10

5. On a scale of 1-10 with 1 being the least pleasant and 10 being the most pleasant, how pleasantly scented was this product?

   1 2 3 4 5 6 7 8 9 10

6. On a scale of 1-10 with 1 being the lowest and 10 being the highest, what quality level do you perceive this product to be?

   1 2 3 4 5 6 7 8 9 10

7. How much would you be willing to pay for 500ml of this product? (Show 500ml bottle for reference size)
   £_______________

8. On a scale of 1-10 with 1 being extremely unlikely and 10 being extremely likely, how likely would you be to purchase this product in the future?

   1 2 3 4 5 6 7 8 9 10

Product 2

1. On a scale of 1-10 with 1 being the hardest and 10 being the easiest, how easy was this product to use?

   1 2 3 4 5 6 7 8 9 10

2. On a scale of 1-10 with 1 being the slowest and 10 being the fastest, how quickly was the cleaning task completed with this product?

   1 2 3 4 5 6 7 8 9 10

3. On a scale of 1-10 with 1 being the least efficient and 10 being the most efficient, how efficient was this product at the cleaning task?

   1 2 3 4 5 6 7 8 9 10

4. On a scale of 1-10 with 1 being the shortest and 10 being the longest, how long-lasting do you think the effects of this product would be?

   1 2 3 4 5 6 7 8 9 10

5. On a scale of 1-10 with 1 being the least pleasant and 10 being the most pleasant, how pleasantly scented was this product?

   1 2 3 4 5 6 7 8 9 10

6. On a scale of 1-10 with 1 being the lowest and 10 being the highest, what quality level do you perceive this product to be?

   1 2 3 4 5 6 7 8 9 10

7. How much would you be willing to pay for 500ml of this product? (Show 500ml bottle for reference size)

£_______________

8. On a scale of 1-10 with 1 being extremely unlikely and 10 being extremely likely, how likely would you be to purchase this product in the future?

1 2 3 4 5 6 7 8 9 10

Product 3

1. On a scale of 1-10 with 1 being the hardest and 10 being the easiest, how easy was this product to use?

   1 2 3 4 5 6 7 8 9 10

2. On a scale of 1-10 with 1 being the slowest and 10 being the fastest, how quickly was the cleaning task completed with this product?

   1 2 3 4 5 6 7 8 9 10

3. On a scale of 1-10 with 1 being the least efficient and 10 being the most efficient, how efficient was this product at the cleaning task?

   1 2 3 4 5 6 7 8 9 10

4. On a scale of 1-10 with 1 being the shortest and 10 being the longest, how long-lasting do you think the effects of this product would be?

   1 2 3 4 5 6 7 8 9 10

5. On a scale of 1-10 with 1 being the least pleasant and 10 being the most pleasant, how pleasantly scented was this product?

   1 2 3 4 5 6 7 8 9 10

6. On a scale of 1-10 with 1 being the lowest and 10 being the highest, what quality level do you perceive this product to be?

   1 2 3 4 5 6 7 8 9 10

7. How much would you be willing to pay for 500ml of this product? (Show 500ml bottle for reference size)

£_______________

8. On a scale of 1-10 with 1 being extremely unlikely and 10 being extremely likely, how likely would you be to purchase this product in the future?

1 2 3 4 5 6 7 8 9 10

<u>Product 4</u>

1. On a scale of 1-10 with 1 being the hardest and 10 being the easiest, how easy was this product to use?

   1 2 3 4 5 6 7 8 9 10

2. On a scale of 1-10 with 1 being the slowest and 10 being the fastest, how quickly was the cleaning task completed with this product?

   1 2 3 4 5 6 7 8 9 10

3. On a scale of 1-10 with 1 being the least efficient and 10 being the most efficient, how efficient was this product at the cleaning task?

   1 2 3 4 5 6 7 8 9 10

4. On a scale of 1-10 with 1 being the shortest and 10 being the longest, how long-lasting do you think the effects of this product would be?

   1 2 3 4 5 6 7 8 9 10

5. On a scale of 1-10 with 1 being the least pleasant and 10 being the most pleasant, how pleasantly scented was this product?

   1 2 3 4 5 6 7 8 9 10

6. On a scale of 1-10 with 1 being the lowest and 10 being the highest, what quality level do you perceive this product to be?

   1 2 3 4 5 6 7 8 9 10

7. How much would you be willing to pay for 500ml of this product? (Show 500ml bottle for reference size)

£_______________

8. On a scale of 1-10 with 1 being extremely unlikely and 10 being extremely likely, how likely would you be to purchase this product in the future?

1 2 3 4 5 6 7 8 9 10

Product 5

1. On a scale of 1-10 with 1 being the hardest and 10 being the easiest, how easy was this product to use?

   1 2 3 4 5 6 7 8 9 10

2. On a scale of 1-10 with 1 being the slowest and 10 being the fastest, how quickly was the cleaning task completed with this product?

   1 2 3 4 5 6 7 8 9 10

3. On a scale of 1-10 with 1 being the least efficient and 10 being the most efficient, how efficient was this product at the cleaning task?

   1 2 3 4 5 6 7 8 9 10

4. On a scale of 1-10 with 1 being the shortest and 10 being the longest, how long-lasting do you think the effects of this product would be?

   1 2 3 4 5 6 7 8 9 10

5. On a scale of 1-10 with 1 being the least pleasant and 10 being the most pleasant, how pleasantly scented was this product?

   1 2 3 4 5 6 7 8 9 10

6. On a scale of 1-10 with 1 being the lowest and 10 being the highest, what quality level do you perceive this product to be?

   1 2 3 4 5 6 7 8 9 10

7. How much would you be willing to pay for 500ml of this product? (Show 500ml bottle for reference size)

£______________

8. On a scale of 1-10 with 1 being extremely unlikely and 10 being extremely likely, how likely would you be to purchase this product in the future?

   1 2 3 4 5 6 7 8 9 10

Product 6

1. On a scale of 1-10 with 1 being the hardest and 10 being the easiest, how easy was this product to use?

   1 2 3 4 5 6 7 8 9 10

2. On a scale of 1-10 with 1 being the slowest and 10 being the fastest, how quickly was the cleaning task completed with this product?

   1 2 3 4 5 6 7 8 9 10

3. On a scale of 1-10 with 1 being the least efficient and 10 being the most efficient, how efficient was this product at the cleaning task?

   1 2 3 4 5 6 7 8 9 10

4. On a scale of 1-10 with 1 being the shortest and 10 being the longest, how long-lasting do you think the effects of this product would be?

   1 2 3 4 5 6 7 8 9 10

5. On a scale of 1-10 with 1 being the least pleasant and 10 being the most pleasant, how pleasantly scented was this product?

   1 2 3 4 5 6 7 8 9 10

6. On a scale of 1-10 with 1 being the lowest and 10 being the highest, what quality level do you perceive this product to be?

   1 2 3 4 5 6 7 8 9 10

7. How much would you be willing to pay for 500ml of this product? (Show 500ml bottle for reference size)

£_______________

8. On a scale of 1-10 with 1 being extremely unlikely and 10 being extremely likely, how likely would you be to purchase this product in the future?

   1 2 3 4 5 6 7 8 9 10

9. Which of these products would you like to take home with you? Please provide your reasons for this choice. You are only allowed to take one product home.

   1.
   ____

   ____

   2.
   ____

   ____

   3.
   ____

   ____
   ____

   4.
   ____

   ____

APPENDIX 4: STUDY SET UP

APPENDIX 5: CORRELATIONS BETWEEN PRODUCT CHARACTERISTIC RATINGS

Appendix 5a: Correlations between product characteristic ratings (Mr Muscle)

	Ease of Use	**Speed**	**Efficiency**	**Long Lasting**	**Scent**	**Quality**	**Future Purchase Intentions**
Ease of Use	1	.871**	.832**	.545**	.462**	.839**	.669**
Speed	.871**	1	.904**	.543**	.502**	.847**	.691**
Efficiency	.832**	.904**	1	.575**	.514**	.856**	.709**
Long Lasting	.545**	.543**	.575**	1	.253*	.625**	.427**
Scent	.462**	.502**	.514**	.253*	1	.555**	.527**
Quality	.839**	.847**	.856**	.625**	.555**	1	.776**
Future Purchase Intentions	.669**	.691**	.709**	.427**	.527**	.776**	1

**Correlation is significant at 0.01 level

* Correlation is significant at 0.05 level

Appendix 5b: Correlations between product characteristic ratings (Dettol)

	Ease of Use	**Speed**	**Efficiency**	**Long Lasting**	**Scent**	**Quality**	**Future Purchase Intentions**
Ease of Use	1	.851**	.836**	.627**	.321**	.742**	.507**
Speed	.851**	1	.868**	.527**	.343**	.759**	.569**
Efficiency	.836**	.868**	1	.539**	.357**	.780**	.588**
Long Lasting	.627**	.527**	.539**	1	.095	.504**	.281*
Scent	.321**	.343**	.357**	.095	1	.595**	.505**
Quality	.742**	.759**	.780**	.504**	.595**	1	.757**
Future Purchase Intentions	.507**	.569**	.588**	.281**	.505**	.757**	1

**Correlation is significant at 0.01 level

* Correlation is significant at 0.05 level

Appendix 5c: Correlations between product characteristic ratings (Ecover)

	Ease of Use	Speed	Efficiency	Long Lasting	Scent	Quality	Future Purchase Intentions
Ease of Use	1	.792**	.740**	.464**	.458**	.712**	.604
Speed	.792**	1	.856**	.570**	.442**	.830**	.665**
Efficiency	.740**	.856**	1	.565**	.455**	.831**	.736**
Long Lasting	.464**	.570**	.565**	1	.267*	.538**	.485**
Scent	.458**	.442**	.455**	.267*	1	.654**	.590**
Quality	.712**	.830**	.831**	.538**	.654**	1	.781**
Future Purchase Intentions	.604**	.665**	.736**	.485**	.590**	.781**	1

**Correlation is significant at 0.01 level

* Correlation is significant at 0.05 level

Appendix 5d: Correlations between product characteristic ratings (Flash)

	Ease of Use	Speed	Efficiency	Long Lasting	Scent	Quality	Future Purchase Intentions
Ease of Use	1	.846**	.818**	.494**	.178	.710**	.606**
Speed	.846**	1	.873**	.543**	.147	.740**	.610**
Efficiency	.818**	.873**	1	.607**	.184	.800**	.744**
Long Lasting	.494**	.543**	.607**	1	.127	.426**	.376**
Scent	.178	.147	.184	.127	1	.306**	.391**
Quality	.710**	.740**	.800**	.426**	.306**	1	.739**
Future Purchase Intentions	.606**	.610**	.744**	.376**	.391**	.739**	1

**Correlation is significant at 0.01 level

*Correlation is significant at 0.05 level

Appendix 5e: Correlations between product characteristic ratings (Method)

	Ease of Use	Speed	Efficiency	Long Lasting	Scent	Quality	Future Purchase Intentions
Ease of Use	1	.826**	.801**	.507**	.391**	.748**	.661**
Speed	.826**	1	.844**	.633**	.361**	.774**	.731**
Efficiency	.801**	.844**	1	.646**	.404**	.800**	.732**
Long Lasting	.507**	.633**	.646**	1	.244*	.684**	.648**
Scent	.391**	.361**	.404**	.244	1	.506**	.529**
Quality	.748**	.774**	.800**	.684**	.506**	1	.832**
Future Purchase Intentions	.661**	.731**	.732**	.648**	.529**	.832**	1

**Correlation is significant at 0.01 level

*Correlation is significant at 0.05 level

Appendix 5f: Correlations between product characteristic ratings (Cif)

	Ease of Use	**Speed**	**Efficiency**	**Long Lasting**	**Scent**	**Quality**	**Future Purchase Intentions**
Ease of Use	1	.763**	.599**	.474**	.472**	.714**	.510**
Speed	.763**	1	.828**	.524**	.423**	.816**	.684**
Efficiency	.599**	.828**	1	.440**	.361**	.720**	.606**
Long Lasting	.474**	.524**	.440**	1	.029	.465**	.281*
Scent	.472**	.423**	.361**	.029	1	.499**	.641**
Quality	.714**	.816**	.720**	.465**	.499**	1	.737**
Future Purchase Intentions	.510**	.684**	.606**	.281*	.641**	.737**	1

**Correlation is significant at 0.01 level

* Correlation is significant at 0.05 level

APPENDIX 6: GREEN AWARE CONDITION SURVEY MATERIALS
<u>Ecozone 3in1 Antibacterial Multi Surface Cleaner</u>

Product information:

Our multi-surface cleaner is multi-marvellous. It uses natural plant extracts to clean and protect your surfaces killing 99.9% of bacteria dead. It removes grease and grime from almost any surface around your home.

Product ingredient information:

Aqua, Pheynol alcohol, sodium cumenesulfonate, hydroxydichlorodipheyl ether, benzisothiazolinone, Methylisothiazolinone, CI 19140, CI 42051, perfume, butylphenyl methylpropional, citronellol, linalool, limonene, hexyl cinnamal, amyl cinnamal, citral.

Product safety information:

Keep out of kids' reach. Avoid contact with eyes. If contact does occur, flush immediately with plenty of water and consult a doctor if any symptoms persist. Avoid contact with skin. Wash your hands thoroughly after use. If you've got any cuts and grazes, wear protective gloves. Always test on an inconspicuous area first. Seek medical advice if swallowed.

Product usage/storage information:
Store upright in a cool, dry place.

APPENDIX 7: CONVENTIONAL AWARE CONDITION SURVEY MATERIAL

Flash Clean and Shine Crisp Lemons All Purpose Cleaner

Product information:

Flash Clean and Shine Crisp Lemons is the All Purpose Spray Cleaner that offers you a universal solution for your entire home, so you don't need hundreds of cleaners under the sink! Flash multipurpose spray cleaner dissolves grease and dirt, leaving freshness and brilliant shine, so you can easily clean everyday dirt and grease such as food spillages in the kitchen, toothpaste, makeup residues, soap scum in the bathroom, leaving a fresh smell in the room.

- A universal solution for your entire home
- All Purpose Spray Cleaner

- Great Flash cleaning power

- Leaves your floor surfaces sparkling clean and smelling fresh

  Cuts grease, soap scum and dirt
- Perfect for hard, washable surfaces
- Flash

Product ingredients: Aqua, C9-11 Pareth-8, Deceth-8, Sodium Citrate, Sodium Palm Kernelate, Sodium Carbonate, Parfum, Sodium Diethylenetriamine pentamethylene phosphonate, limonene, dipropylene glycol, citral, linalool, hexyl cinnamal, butoxydiglycol, benzisothiazolinone, Sodium hydroxide, triethanolamine ethoxylated, colourant

Storage and usage information:

Storage: Ambient, keep away from children. Spray the cleaner on your hard surfaces and wipe with a dry or damp cloth. For Heavy soil or bacteria kill: leave the cleaning spray to act for a 3 minutes before wiping. On waxed or painted surfaces: test the surface cleaner first on a small inconspicuous area before use. Keep bottle upright.

Safety information:

Causes serious eye irritation. If medical advice is needed, have product container or label at hand. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Do not breathe spray.

(Information taken and adapted from https://www.tesco.com/groceries/en-GB/products/261537000, originally accessed 10/03/2018)

APPENDIX 8: GREEN BLIND CONDITION SURVEY MATERIALS

Product 1

Product information:

Our multi-surface cleaner is multi-marvellous. It cleans and protects your surfaces killing 99.9% of bacteria dead. It removes grease and grime from almost any surface around your home.

Product ingredient information:

Aqua, Pheynol alcohol, sodium cumenesulfonate, hydroxydichlorodipheyl ether, benzisothiazolinone, Methylisothiazolinone, CI 19140, CI 42051, perfume, butylphenyl methylpropional, citronellol, linalool, limonene, hexyl cinnamal, amyl cinnamal, citral.

Product safety information:

Keep out of kids’ reach. Avoid contact with eyes. If contact does occur, flush immediately with plenty of water and consult a doctor if any symptoms persist. Avoid contact with skin. Wash your hands thoroughly after use. If you’ve got any cuts and grazes, wear protective gloves. Always test on an inconspicuous area first. Seek medical advice if swallowed.

Product usage/storage information:

Store upright in a cool, dry place.

APPENDIX 9: CONVENTIONAL CONTROL CONDITION SURVEY MATERIALS

Product information:

This product offers you a universal solution for your entire home, so you don’t need hundreds of cleaners under the sink! This multipurpose spray cleaner dissolves grease and dirt, leaving freshness and brilliant shine, so you can easily clean everyday dirt and grease such as food spillages in the kitchen, toothpaste, makeup residues, soap scum in the bathroom, leaving a fresh smell in the room.

- A universal solution for your entire home
- All Purpose Spray Cleaner
- Leaves your floor surfaces sparkling clean and smelling fresh
- Cuts grease, soap scum and dirt
- Perfect for hard, washable surfaces

Product ingredients: Aqua, C9-11 Pareth-8, Deceth-8, Sodium Citrate, Sodium Palm Kernelate, Sodium Carbonate, Parfum, Sodium Diethylenetriamine pentamethylene phosphonate, limonene, dipropylene glycol, citral, linalool, hexyl cinnamal, butoxydiglycol, benzisothiazolinone, Sodium hydroxide, triethanolamine ethoxylated, colourant

Storage and usage information:

Storage: Ambient, keep away from children. Spray the cleaner on your hard surfaces and wipe with a dry or damp cloth. For Heavy soil or bacteria kill: leave the cleaning spray to act for a 3 minutes before wiping. On waxed or painted surfaces: test the surface cleaner first on a small inconspicuous area before use. Keep bottle upright.

Safety information:

Causes serious eye irritation. If medical advice is needed, have product container or label at hand. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do.

Continue rinsing. Do not breathe spray.

APPENDIX 10: TABLE EXPLAINING FUNCTIONS OF INGREDIENTS IN A CLEANING PRODUCT

Category	***Description***
Builder	Help to soften the water, maintain pH, and to keep the removed dirt from going back onto the cleaned surface.
Colourants	Change the colour of the product.
Disinfectants	Remove infectious or unwanted bacteria, fungi or viruses on surfaces.
Fragrances	Covers the smell of the base product and improves the scent of the product
Preservatives	Prevent damage to the product from bacteria or other micro-organisms.
Solvents	Used to dissolve other ingredients.
Surfactants	Used to assist cleansing, wetting surfaces, foaming and combining all the ingredients in the product. They help to remove grease and oil from surfaces.

APPENDIX 11: SURVEY MATERIALS

<u>Title – An online survey</u>

You are being invited to take part in a research study titled [insert title when I have one]. This study is being done by Rachel Hollis from the University of Leeds.

The purpose of this research study is to see how consumers may use information provided alongside cleaning products to make decisions regarding these products. It will take approximately 35 minutes to complete. Your participation in this study is entirely voluntary and you can withdraw at any time. If there are any questions you feel uncomfortable with, you are free to miss these out.

There are no known risks associated with this research study. To the best of our ability, your answers in this survey will remain confidential. Data will be stored on a secure computer that only the researcher has access to. The results of this study may be published in an academic journal. You will not be able to be identified in any reports or publications.

Product 1

(Product information would be here, which varied depending on condition. Appendices 6-9 show the different product information for each condition. The rest of the survey was identical across conditions, except for in the aware conditions participants would view a photo of the product on each page of the questionnaire and the product was referred to by name. For the blind conditions, the product was simply referred to as “the product”)

1. On a scale of 1-7, with 1 being the least and 7 being the most, how effective do you think this product would be at performing everyday cleaning tasks?
    a. 1 2 3 4 5 6 7

2. On a scale of 1-7, with 1 being the least and 7 being the most, how harmful do you think this product would be if it came into contact with your skin?

    1 2 3 4 5 6 7

3. On a scale of 1-7, with 1 being the least and 7 being the most, how harmful do you think this product would be to your respiratory system if you breathed it in?

    1 2 3 4 5 6 7

4. On a scale of 1-7, with 1 being the least and 7 being the most, how harmful do you think this product is for the environment?

    1 2 3 4 5 6 7

5. On a scale of 1-7, with 1 being the least and 7 being the most, how harmful do you think this product would be to aquatic life?

    1 2 3 4 5 6 7

6. This product contains Hexyl Cinnamal. From the table of ingredients below, please select the function you think this ingredient performs in the product.

Category	***Description***
Builder	Help to soften the water, maintain pH, and to keep the removed dirt from going back onto the cleaned surface.
Colourants	Change the colour of the product.
Disinfectants	Remove infectious or unwanted bacteria, fungi or viruses on surfaces.
Fragrances	Covers the smell of the base product and improves the scent of the product
Preservatives	Prevent damage to the product from bacteria or other micro-organisms.
Solvents	Used to dissolve other ingredients.
Surfactants	Used to assist cleansing, wetting surfaces, foaming and combining all the ingredients in the product. They help to remove grease and oil from surfaces.

7. On a scale of 1-7, with 1 being the least and 7 being the most, how harmful do you think this ingredient would be if it came into contact with your skin?

   1 2 3 4 5 6 7

8. On a scale of 1-7, with 1 being the least and 7 being the most, how harmful do you think this ingredient would be to your respiratory system if you breathed it in?

   1 2 3 4 5 6 7

9. 9. On a scale of 1-7, with 1 being the least and 7 being the most, how harmful do you think this ingredient is for the environment?

   1 2 3 4 5 6 7

10. On a scale of 1-7, with 1 being the least and 7 being the most, how harmful do you think this ingredient would be to aquatic life?

    1 2 3 4 5 6 7

11. This product contains Benzisothiazolinone. From the table of ingredients below, please select the function that you think this

ingredient performs in the product.

Category	***Description***
Builder	Help to soften the water, maintain pH, and to keep the removed dirt from going back onto the cleaned surface.
Colourants	Change the colour of the product.
Disinfectants	Remove infectious or unwanted bacteria, fungi or viruses on surfaces.
Fragrances	Covers the smell of the base product and improves the scent of the product
Preservatives	Prevent damage to the product from bacteria or other micro-organisms.
Solvents	Used to dissolve other ingredients.
Surfactants	Used to assist cleansing, wetting surfaces, foaming and combining all the ingredients in the product. They help to remove grease and oil from surfaces.

12. On a scale of 1-7, with 1 being the least and 10 being the most, how harmful do you think this ingredient would be if it came into contact with your skin?

1 2 3 4 5 6 7

13. On a scale of 1-7, with 1 being the least and 7 being the most, how harmful do you think this ingredient would be to your respiratory system if you breathed it in?

    1 2 3 4 5 6 7

14. On a scale of 1-7, with 1 being the least and 7 being the most, how harmful do you think this ingredient is for the environment?

    1 2 3 4 5 6 7

15. On a scale of 1-7, with 1 being the least and 7 being the most, how harmful do you think this ingredient would be to aquatic life?

    1 2 3 4 5 6 7

16. This product contains Limonene. From the table of ingredients below, please select the function that you think this ingredient performs in the product.

Category	*Description*
Builder	Help to soften the water, maintain pH, and to keep the removed dirt from going back onto the cleaned surface.
Colourants	Change the colour of the product.
Disinfectants	Remove infectious or unwanted bacteria, fungi or viruses on surfaces.
Fragrances	Covers the smell of the base product and improves the scent of the product
Preservatives	Prevent damage to the product from bacteria or other micro-organisms.
Solvents	Used to dissolve other ingredients.
Surfactants	Used to assist cleansing, wetting surfaces, foaming and combining all the ingredients in the product. They help to remove grease and oil from surfaces.

17. On a scale of 1-7, with 1 being the least and 10 being the most, how harmful do you think this ingredient would be if it came into contact with your skin?

1 2 3 4 5 6 7

18. On a scale of 1-7, with 1 being the least and 7 being the most, how harmful do you think this ingredient would be to your respiratory system if you breathed it in?

    1 2 3 4 5 6 7

19. On a scale of 1-7, with 1 being the least and 7 being the most, how harmful do you think this ingredient is for the environment?

    1 2 3 4 5 6 7

20. On a scale of 1-7, with 1 being the least and 7 being the most, how harmful do you think this ingredient would be to aquatic life?

    1 2 3 4 5 6 7

21. On a scale of 1-7, with 1 being the least and 7 being the most, how useful was the ingredient list and product information for helping you to answer these questions?
    1 2 3 4 5 6 7

22. 12. On a scale of 1-7, with 1 being the least and 7 being the most, how familiar were you with the ingredients contained in this list?

    1 2 3 4 5 6 7

The next part of this study involves a short questionnaire about some background information, including your age, gender, shopping/cleaning habits and familiarity with different brands of cleaning products. This section will take about five minutes to complete.

11. How old are you?

____

12. What is your gender?

Male *Female* *Non-Binary* *Other*

13. Choose one option that best describes your ethnic group or background.

White British *White European* *Mixed Background*

Asian/Asian-British *Black/African/Caribbean/Black British*

Other

If you selected "Other", please specify:

____

____

14. What is the highest level of education you have received? If you are still currently in education, take the qualification for which you are studying as your highest level of education.

No Education Completed *Primary School* *GCSE's or Equivalents*

A Levels or Equivalents *Undergraduate Degree or Equivalent*

Masters Degree *PhD*

15. How many people live in your household including yourself?

1 *2* *3* *4* *5* *6* *7+*

16. Are you the main person responsible for purchasing cleaning products in your household? If no, please skip to question 8.

Yes *No*

17. If yes, how regularly do you purchase household cleaning products?

More than 1x per week *Once a week* *Once a fortnight*

Once a month *Less frequently than once a month*

18. Are you the main person responsible for cleaning in your household?

Yes *No*

19. How frequently do you use multipurpose household cleaning products?

Multiple times per day *Daily* *Every other day*
Weekly

Fortnightly *Monthly* *Less frequently than once a month*

20. What is most important to you when selecting a multipurpose household cleaning product? If you are not the main person responsible for purchasing household cleaning products, please answer with what would be most important to you if you were.

Price *Quantity* *Brand* *Scent* *Colour*

Sensitive Skin Ingredients *Eco-friendly products*
Strength

If it is on offer *If you have used it before* *Other*

If you selected “Other”, please specify:

____

____

11. Of the following brands of multipurpose household cleaner products, have you used or purchased these in the last month?.

Cif (Yes/No) *Flash (Yes/No)* *Dettol (Yes/No)*

Supermarket own brand (Yes/No) *Mr Muscle (Yes/No)* *Astonish (Yes/No)*

Stardrops (Yes/No) *Method (Yes/No)* *Domestos (Yes/No)*

Ecover (Yes/No) *Cillit Bang (Yes/No)* *Ecozone (Yes/No)*

Other (Yes/No)

If you selected “Other”, please specify:

____

You will now be presented with a final questionnaire to assess your beliefs about the environment. This will take about five minutes to complete.

On a scale of 1-5, with 1 being Strongly Agree and 5 being Strongly Disagree, please rate how much you agree with the following statements.

1. We are approaching the limit of the number of people the Earth can support.

1 2 3 4 5

2. Humans have the right to modify the natural environment to suit their needs.

1 2 3 4 5

3. When humans interfere with nature it often produces disastrous consequences.

1 2 3 4 5

4. Human ingenuity will insure that we do not make the Earth unliveable.

1 2 3 4 5

5. Humans are seriously abusing the environment.

1 2 3 4 5

6. The Earth has plenty of natural resources if we just learn how to develop them.

1 2 3 4 5

7. Plants and animals have as much right as humans to exist.

1 2 3 4 5

8. The balance of nature is strong enough to cope with the impacts of modern industrial nations.

1 2 3 4 5

9. Despite our special abilities, humans are still subject to the laws of nature.

1 2 3 4 5

10. The so-called "ecological crisis" facing humankind has been greatly exaggerated.

1 2 3 4 5

11. The Earth is like a spaceship with very limited room and resources.

1 2 3 4 5

12. Humans were meant to rule over the rest of nature.

1 2 3 4 5

13. The balance of nature is very delicate and easily upset.

1 2 3 4 5

14. Humans will eventually learn enough about how nature works to be able to control it.

1 2 3 4 5

15. If things continue on their present course, we will soon experience a major ecological catastrophe.

1 2 3 4 5

Debrief Information

Thank you for taking part in this study. The following information explains a little more about the project.

This study aimed to see how consumers use the information provided by the companies that make cleaning products to make informed decisions about the products. New legislation has placed a bigger emphasis on providing information to consumers about what is contained in the products they can buy, and part of this involves providing more detailed ingredients lists. However, it is still unclear whether consumers understand this information or not, and how helpful ingredient lists are to consumers.

If you would like any further information about this study, please contact

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