

The Effects of Parasite Stress Levels on
Conspicuous Consumption and Neophobia

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Abstract

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In addition to the classical human immune system, aspects of human behaviour act as a form of behavioural immune response. When faced with a higher perceived likelihood of contracting parasitic/infectious disease, humans respond with behavioural changes which are adaptations that allow for stronger *fitness*, a measure of the likelihood of one's genes being carried on to the following generation. The increased fitness can be achieved through a stronger likelihood of survival, having more offspring, or a combination of the two. The behavioural changes tested were conspicuous consumption and neophobia, both of which have implications on consumer behaviour. Examples of conspicuous consumption include men's purchase of visible brands that display wealth and/or social status, and women's consumption of products or services related to beauty. Neophobia is the fear of new things, whether it be social interactions or the purchase or adoption of new products. Together, conspicuous consumption and neophobia map onto the reproductive and survival Darwinian modules. The current research tested changes in behaviour based on perceived vulnerability to parasites. This was achieved by conducting a cross-cultural survey and an experiment using visual cues to illicit a change in perceived vulnerability. This study provided evidence that perceived vulnerability to parasites can cause increased levels of conspicuous consumption, general neophobia and, to a smaller effect, food neophobia. The changes in behaviours demonstrated in response to a perceived vulnerability to infectious disease may have an effect on types of consumer behaviours such as purchasing decisions with regards to brands and status as well as new product adoption.

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Introduction

Like our classical immune system, humans have a behavioural immune system that vastly affects our psychology and behaviours in an effort to overcome or avoid illness (Miller and Maner 2011; Schaller and Park 2011; Miller and Maner 2012; Murray and Schaller 2016). These changes in behaviour are thought to be psychological evolutionary adaptations that increase individual fitness, at least in an evolutionary ancestral setting in which they evolved (Schaller and Duncan 2007). In this paper, I argue that the behavioural immune system alters behaviours that affect two Darwinian modules (survival and reproduction). Neophobia was chosen to represent the survival module of natural selection as it is a behaviour that can limit reproductive opportunities but, which plays a key role in avoiding death (Brown et al. 2015; Elvidge et al. 2016). On the other hand, conspicuous consumption is used to test how much reproductive-related behaviours are affected. Conspicuous consumption is seen as a form of handicapping where an individual sacrifices resources to better and more explicitly show their mate value (Saad 2007; Sundie et al. 2011). The objective is to demonstrate that these two behaviours are affected by our behavioural immune systems via both a cross-cultural study and an experiment with visual primes.

One way in which these behaviours may be influenced is through differences in people's environment. There are many environmental factors which could play a role in altering behaviour but, this paper uses perceived parasite stress levels to build off of previous research stemming from the parasite stress theory. Historical research in parasite-stress theory has created a stream of studies proving that the prospect of parasitic and infectious disease alters social behaviours such as in-group assortative behaviour including xenophobia (dislike of outsiders), philopatry (lack of dispersal from one's place of birth), etc. (Thornhill and Fincher 2012, 2014).

Following an overview on evolutionary psychology's link to consumer behaviour, I review the specific development of parasite stress theory and expand how it can be used to further show that the behavioural immune system is an evolutionary adaptation helping to increase an individual's fitness by changing human behaviours. Finally, I will connect how the changes in behaviour associated with the behavioural immune system can affect consumption habits driven by conspicuous consumption and neophobia.

Theoretical Background

Evolutionary psychology posits that many current human behaviours and thoughts are shaped by natural or sexual selection (Saad 2007). In the same way the male peacock grows bright plumage or penguins find the perfect rock to woo a mate, the human mind was shaped by selective pressures which influenced our ability to survive and reproduce, otherwise known as fitness.

Evolutionary psychology attempts to not only understand current behaviours using an adaptationist lens but also find the ultimate mechanisms driving the behaviours in question.

Despite the evolutionary lens being used widely in behavioural biology and a growing use in the social sciences from 1965 to 2000, many of the social sciences have currently failed to significantly accept or adopt evolutionary processes as causal in shaping current cognitive mechanisms (Saad and Gill 2000). Jackson and Rees (2007) contest evolutionary psychology's use in sociology or public wide circulation as it does not account for the diversity of human beings as individuals. Furthermore, the idea that our evolutionary history shapes cognitive biases contradicts the assumption of the human mind being an 'empty slate' posited by the Standard Social Science Model (Jackson and Rees 2007; Tooby and Cosmides 1992 as cited by Saad

2007). These reasons have created a barrier preventing a greater adoption of evolutionary psychology's use in the social sciences. Saad counter argues the idea of human minds being a blank slate by citing various research which illustrates that infants at an age too young to have been socialized having cognitive biases including negativity bias, preference for sweets and avoidance of spiders and snakes (Saad 2020). One social science which has seen progress and a growing body of working using evolutionary psychology is marketing. Saad and Gill argue that using evolutionary psychology allows for predictable behavioural outcomes in consumer behaviour (2000). In particular, the authors explain that evolutionary psychology can be used to explain outcomes of previous literature, current market phenomena, and create new hypotheses to predict consumption related behaviours (Saad and Gill 2000). The current paper will seek to reiterate and strengthen the argument of the benefits to incorporating evolutionary psychology in consumer behaviour along with the other social sciences. To achieve this objective, the current paper evaluates how environmental factors can shape consumption behaviours. More specifically, perceived parasite stress levels will be the environmental variable used to test how it affects conspicuous consumption and neophobia, which will represent exemplars of the reproductive and survival Darwinian modules respectively. The paper will start by providing an overview of parasite stress theory before exploring the variables of conspicuous consumption and neophobia in greater depth.

Parasite Stress Theory

Parasite stress theory uses the domains of evolutionary psychology and biology to explain changes in behaviour caused by increased parasite stress. Stress caused by parasites increases mortality and morbidity, which thereby act as selective pressures, possibly influencing life history strategies; increased mortality caused by infectious disease can influence how resources

need to be allocated in order to optimize fitness which can result in different life histories (Smith and Smith 2012). This section will explore how stimuli or geographic location can alter perceived vulnerability to infectious disease. Following this, more background will be provided about previous behaviours that have been studied in the domain of parasite stress theory and to provide further evidence that the behavioural immune response is an adaptation that would aid in reducing the exposure to novel parasites or disease.

Prior to examining the behavioural immune system, one must start by understanding how the classical immune system can be influenced by parasite stress. Schaller et al. (2010) demonstrated that merely exposing people to visual stimuli of individuals with visible symptoms of illness increased classical immune system responses. This study was able to quantifiably measure an immune system's biological response to just the perception of an increased likelihood to contract parasitic/infectious disease. Understanding that the classical immune response could be influenced using only visual stimuli, it would stand to reason that a changed perception of vulnerability to disease could influence not only physiological responses but, behavioural responses as well. In fact, various studies have provided evidence that a different immune system, a behavioural immune system, uses anti-parasitic psychology and behaviour to prevent and manage the risk of parasitic and infectious disease (Faulkner et al. 2004; Navarrete and Fessler 2006; Fincher and Thornhill 2012; Thornhill and Fincher 2014). This type of immune response is quite different when compared to the classical immune response, which use biochemicals produced by the body along with cellular adaptation to defend against parasites and disease (Schaller and Duncan 2007). Earlier works uncovered a correlation between perceived vulnerability to infectious disease and ancestrally adapted feelings, attitudes, values, and in-group/out-group sociality (Faulkner et al. 2004; Navarrete and Fessler 2006). Further evidence

for behavioural adaptations to cope with increased parasite stress was illustrated by a study using spice preference across cultures. Apart from being more palatable, cultures based in warmer and wetter climates which had increased likelihood of parasite transference used spices more frequently, likely due to their anti-microbial properties (Billing and Sherman 1998). Other behavioural immune responses include the avoidance of nonhuman animals when an individual perceives a higher risk of infection (Prokop et al. 2010a; 2010b).

The concept of a behavioural adaptation to the likelihood of parasitic and infectious disease transmission led to the Parasite stress theory. Parasite stress theory uses a gradient that measures the different levels of parasite stress cross-culturally; the theory suggests that as parasite stress levels increase, behaviour will change to create stronger ties with closely related groups and create greater distance with less familiar groups of individuals as a means to prevent the spread of novel illnesses (Fincher and Thornhill 2012). Considering parasite stress levels differ in geographic areas around the world, theoretically, the behavioural immune system should be adapted differently across geographic areas based on higher (or lower) levels of parasite stress. Several studies have focused on assortative social behaviours to support this hypothesis. Assortative social behaviours are behaviours in which humans can create more distinct divides between groups of individuals; this allows groups to be exclusive and thereby helps to limit the amount of interactions with individuals from foreign groups (Fincher and Thornhill 2008; Fincher et al. 2008). The previous studies on assortative sociality highlighted behaviours that limit contact with out-group members, reducing chances of novel parasite transmission; these included behaviours such as xenophobia, ethnocentrism, and philopatry (Fincher and Thornhill 2012). Xenophobia is an aversion to out-group members; ethnocentrism is the mentality of placing more importance on in-group members; and philopatry is the lack of dispersal from one's

place of birth (Fincher and Thornhill 2012). Xenophobia, ethnocentrism, and philopatry represent the three components of assortative sociality, which are out-group dislike, in-group favouritism, and lack of dispersal from place of birth for the purposes of reproduction (Fincher and Thornhill 2012; Fincher and Thornhill 2008; Fincher et al. 2008). These behavioural changes that were found due to parasite stress levels serve as compelling evidence that these changes may be evolutionary behavioural adaptations to cope with environmental stressors. This would further imply that other behaviours, including certain consume-related behaviours, can also be affected by environmental factors such as parasite stress levels.

To further support the theory that behaviours, including potential consumer behaviours, can be affected by environmental factors (specifically perceived parasite stress levels), I examine next behavioural changes associated parasite stress starting with nonhuman primates before expanding to experiments conducted on humans. This stream of research continues to solidify that xenophobia, ethnocentrism, and philopatry seemed to have developed, at least in part, as adaptive mechanisms for dealing with increased risk of disease and parasites as it has been exhibited in some of the closest related species to humans. For instance, Freeland (1979) found that in areas of increased disease stress, primates used social grouping to create islands, distinct and geographically exclusive populations from other primates. It was found that primates under higher parasite stress were less open and sociable with outsiders (Freeland 1979). Subsequent research showed some components of assortative sociality, xenophobia, and ethnocentrism were correlated with the degree of perceived vulnerability to disease (Faulkner et al. 2004; Navarrete and Fessler 2006). More specifically, these studies revealed that individuals who perceived a larger risk to infectious disease were more xenophobic and ethnocentric (Faulkner et al. 2004; Navarrete and Fessler 2006). Interestingly, parts of these studies put forward that visual stimuli

could be used to elicit increased perceived vulnerability to disease (Faulkner et al. 2004; Navarrete and Fessler 2006). This was further supported by a subsequent paper that presented pictures depicting people with visual symptoms of disease causing the participants' immune systems to be influenced (Schaller et al. 2010). By merely being shown pictures of people with visual symptoms of disease, participants experienced an immediate immunological response (Schaller et al. 2010). That visual cues of disease could influence humans' perceived vulnerability to disease and thereby create a biological response gives rise to the possibility that a change in behaviour is an immune response developed as an adaptation analogous to the biological immune response. Showing a change in behaviour due to environmental factors to protect or prevent vulnerability to disease would strengthen the evidence for the existence of a behavioural immune system that is also phenotypically plastic (i.e., malleable). The ability to change behaviour with visual cues is the first indication that a greater understanding of the influence of parasite stress could allow for potential applications in consumer behaviour.

Fincher and Thornhill (2012) probed deeper into the effects of parasite stress levels on a more granular level. After accounting for the possible confound of societal wealth, they found that nonzoonotic infectious disease (only transferable between humans) were significantly more important in explaining social patterns than zoonotic infectious disease (not transmissible through humans). In the same cross-cultural study, it was also shown that family ties along with religious affiliation and participation were positively correlated to a larger amount of infectious disease. Since collectivist societies are positively related to stronger family ties, xenophobia, and ethnocentrism, it is possible that being more strongly connected to a family is a behavioural adaptation used to lower the possibility of transmission of infectious disease (Fincher and Thornhill 2012). Furthermore, Fincher and Thornhill suggest that religion not only aids in

assortative sociality but, may also act as a form of costly signaling (2012). This again re-enforces the idea that there are many behaviours that can be affected by parasite stress levels and that accordingly require further exploration.

This abundance of research has provided thorough evidence that parasite-stress creates a selective pressure for the evolution of the behavioural immune system. Given the cost associated with socially assortative behaviours including strong family ties, xenophobia, ethnocentrism and philopatry, the behaviours appear to be adaptations which are selected for, and hence are not random. For instance, the lack of dispersal and the inevitable inbreeding caused by philopatry could lead to the genetic cost of inbreeding depression (Smith and Smith 2012). However, this behavioural adaptation to reduce interaction with out-group members decreases the introduction of novel parasites and disease (Fincher and Thornhill 2012). It seems as though, in areas of high parasite stress, the costs of inbreeding are negated by the benefits of decreasing the likelihood of infection thus decreasing mortality and increasing fitness. From this, it is clear that the aforementioned social behaviours are behavioural adaptations linked to survival. These examples of behavioural changes indicate the likelihood of individuals or populations under larger parasite stress to be more socially neophobic as this behaviour represents a fitness trade-off allowing for a greater chance of survival. As selective pressure can alter behavioural patterns, it is evident that increased parasite stress can be thought of as a predictor of certain consumer behaviours. Despite literature insinuating that mortality stressors cause behaviour that emphasizes survival, there is contending research demonstrating alternative adaptive behavioural strategies in the mating system. At times, survival and reproduction act as opposing forces due to the investment required to gain mating opportunities; a complete understanding of their interaction and priority would allow more accurate predictions to be drawn regarding consumer behaviour. Next, I offer

insights into how reproduction also causes behavioural changes under environmental stresses. Following a brief history of the relevant literature with a focus on handicapping/honest signalling, the theoretical background will explore the biological concepts of alternative life history, conspicuous consumption, and neophobia prior to discussing the posited hypotheses.

Despite much evidence of behavioural changes that limit social interaction with out-group members, the mating system is actually the origin of parasite-stress research albeit, in birds. The research within mating systems provides proof that certain changes in behaviour are adaptations stemming from evolutionary psychology meant to balance survival and reproduction. One of the first studies done regarding the effects of parasite load on mating systems was conducted by Hamilton and Zuk (1982) whose comparative data not experiment showed that the plumage of North American passerines acted as a sort of honest signaling in the presence of parasites. By allocating more of the body's resources to creating brighter plumage as opposed to the immune system while having a heavier parasite load, the plumage acted as a signal of the genetic superiority of brighter individuals (Hamilton and Zuk 1982). Building off the idea of using genes as an adaptation to parasite stress, Low (1990) found that human populations under higher parasite stress had an increase in polygyny (when a male has multiple female mates), as well as males' mates being less related to one another. These mating preferences allow for a more genetically diverse pool of offspring giving a greater chance for more of the male's progeny to survive and reproduce. The reason this adaptation is more often applied to males is because female fitness is less variable due to the quantity of progeny produced being less variable; their offspring fitness is more importantly tied to their father's genetic quality and parental investment (Trivers and Willard 1973). Considering that an increase in sexual partners puts individuals at greater risk to be infected by disease, it would be counter-intuitive for a more

polygamous (multiple mates) mating system (Valois et al. 1999). As males' fitness has a lot to gain from having access to a greater number of mates, and females' fitness is far less variable, a polygynous mating system makes for a logical equilibrium (Low 1990). The male's risk of disease is outweighed by the benefit of greater genetic variability of offspring produced by many and more unrelated mates (Low 1990). The genetic variability of offspring is more important in stressful and unpredictable environments as the offspring would have a larger ability to adapt to different selective pressures (Smith and Smith 2012). Stressful selective pressures, such as parasite stress levels, result in lower overall health levels and have been shown to affect women's preferences for males with greater facial masculinity (DeBruine et al. 2010). However, men cannot change their facial features; instead certain behaviours such as conspicuous consumption may allow for a larger show of genetic quality through a display of social status (Saad 2007). Along with increased genetic diversity, in more stressful and unpredictable environments, a favourable adaptation is to exhibit a greater phenotypic plasticity (Smith and Smith 2012). The mating preferences outlined earlier establish a couple of major themes that drive human behaviour and consumption habits. Firstly, similar to the bright plumage in the Hamilton and Zuk (1982) study, under higher levels of parasite stress, it may be more important for males to showcase their 'mate value'. Similar to the feathers of a peacock, to be considered a strong and viable mate, the importance of a display of strong genes or resources from a male is amplified. This indicates that males under higher perceived vulnerability to parasitic and infectious disease are more likely to engage in conspicuous consumption that would demonstrate a higher social status. Conversely, as a female's fitness is more strongly related to the male's genetic quality and level of parental investment, rather than increasing their mating opportunities, females are more likely to invest resources to acquire the best male that they can.

In doing this, it would be expected that women would invest more greatly in conspicuous acts that would allow them to look younger and more beautiful. As these behaviours are subject to change based on a change in perceived vulnerability of parasitic and infectious disease, it is important to understand why animals, including humans, change as their environment changes. This change in longer term behaviours and, at times, physiological change based on environmental factors is called alternative life history, which is explored next in greater depth. Following an overview of alternative life histories strategies, the variables chosen to represent the Darwinian modules of survival and reproduction will be further expanded upon.

Life History Theory

The way in which an individual grows, develops, and reproduces throughout their life is called an individual's life history (Smith and Smith 2012). Understanding what causes these changes in behavioural or, at times, physiology, will provide deeper insights into why or how consumption habits can be related to environmental factors. Prior to understanding how to utilize environmental factors to shape marketing decisions, one must understand what exactly an alternative life history is and why it is relevant to parasite stress theory. The two causes of variation in an individual's life histories are the individual's genetic makeup and phenotype plasticity (Smith and Smith 2012). Phenotypic plasticity is the extent that the genetic makeup of an individual can be influenced by the environment resulting in different physical or behavioural traits, the authors continue, explaining that a single genotype (genetic composition of an individual) that allows the phenotype to adjust based on the environment, called a plastic phenotype, would result in increased fitness in stressful and unpredictable environments (Smith and Smith 2012). This supports a previous point as to why males may choose to have more mates, increasing their risk of infection. In unpredictable environments, the more variable a male's

offspring are, the larger his fitness will be as it gives his progeny a better chance to survive regardless of environmental conditions (Low 1990). If individuals from more unpredictable environments have more elastic phenotypes, they are able to change behaviour more quickly; The greater variability in one's behaviour may make these individuals more susceptible to constantly changing environmental factors or stimuli. This change in behaviour can affect behaviours associated with resources including mating systems, food acquisition and social interaction. This variability in human behaviour connected to consumption was illustrated in a study where individuals with cues of a harsher environment exhibited a preference for high-caloric foods (Laran and Salerno 2013).

A deeper, more narrow aspect to life-history strategy when considering parasite stress is age-dependent reproductive strategies. The two major aspects that effect reproductive rate, and thereby fitness, are birthrate and survivorship (Smith and Smith 2012; Del Giudice et al. 2016). There are fitness costs associated with mating such as use of resources to acquire or retain a mate, injury during competition, and direct physiological costs of mating (Smith and Smith 2012). This means, an optimal mating strategy is one that balances the behaviours that increase mating opportunities and success while limiting survival risks along with other environmental factors that can affect an individual's fitness. The environmental factors can drastically alter the optimal energy allocation strategy when comparing stable and unpredictable environments (Del Giudice et al. 2016). For instance, lizard populations within the United States showed that earlier ages of reproduction were associated with higher adult mortality (Tinkle and Ballinger 1972). Providing additional evidence of the value of differing optimal mating strategies, in a subsequent field experiment, guppies introduced into higher predation populations versus lower predation populations allocated more resources to physical gonadal growth resulting in earlier age of

reproduction (Reznick and Endler 1982). Kenrick and Griskevicius (2015) contend that this behavioural phenomenon can be highly variable not only in mammals, but within humans as well. The authors expand on this to argue that environmental factors like local sex ratios, sexy images or romantic stories could alter consumer behaviours resulting in increased conspicuous consumption, polygamy, and risk taking (Griskevicius and Kenrick 2013; Kenrick and Griskevicius 2015). Griskevicius and Kenrick (2015) go on to provide many other examples of environmental cues that can trigger behavioural tendencies including self-protection and diseases avoidance which create risk averse tendencies and preference for familiar products. With this in mind, it would be expected that the resource investment toward mating under higher mortality rates would be evident in conspicuous consumption and/or earlier ages of reproduction.

Although predation stress is not the exact same as parasite stress, the result suggests that an increased likelihood of a shorter lifespan would lead to a greater investment to maturation and/or reproduction at an earlier age. In fact, there are faster developmental rates to maturation in species or populations with higher adult mortality and shorter life cycles (Smith and Smith 2012). Work by Tither and Ellis (2008) put forward that family disruption, in particular residential separation from the father led to earlier menarche in females. The residential separation of the father from the daughters did not specify the reasoning though to explain why populations of higher adult mortality could lead to more family disruption. An earlier study concluded that in the absence of a father, females engage in sexual activity earlier with less discrimination (Draper and Harpending 1982). This variability based on the environment is linked to the idea of 'r' and 'k' selective strategies. In ecology, species tend to be classified as either r or k strategists, meaning either shorter lifespan with larger birthrates or longer lifespan with smaller birthrates respectively (Reece et al. 2011; Smith and Smith 2012). However, if

thought of as a gradient rather than well-defined categories, theoretically, changes in environmental factors could allow phenotypically plastic behaviours to be more r or k strategic without being completely binary. R-strategist populations are shorter lived, live in less dense populations in a more unstable and unpredictable environment, have a larger number of offspring with higher reproductive rates, quicker development, and invest less in each of their offspring (Reece et al. 2011; Smith and Smith 2012). R-strategist can be thought of as rodents like mice or insects like ants which have short life spans but many offspring. Alternatively, K-strategist are animals with larger parental investment like elephants or whales. An increase in parasite stress would make an environment more unstable and result in a higher mortality rate. This suggests that greater parasite stress on a population should lead to a population acting more similar to an r strategy than other populations with lower parasite stress, with all other factors the same. Therefore, the theoretical prediction is that populations under a larger parasite stress would attempt earlier maturation and reproduction with more offspring and less parental investment. Interestingly, Griskevicius et al. (2011) found that in humans, mortality cues affected the timing of reproduction though, the direction (whether earlier or delayed) relied on the individual's childhood socio-economic status. Specifically, people growing up in a resource-scarce environment exhibited earlier desired age of reproduction when faced with cue of mortality where as those from a resource-plentiful showed a desire to delay reproduction when presented mortality cues (Griskevicius et al. 2011). Based on this, it should be expected that as parasite stress increases in a population, individuals will invest more into behaviours and other traits that can help them achieve greater mating and reproductive success. This would again highlight the potentially greater amount of conspicuous consumption occurring in populations under larger parasitic or infectious disease stress. Furthermore, the alternative life history establishes how

these changes in behaviour occur and can be linked to an individual's environment or stimuli. It stands to reason, having an in-depth knowledge of the different ecological variables across geographic areas could allow marketers to more effectively choose marketing strategies based on geography. As the focus of this paper is to specifically look at how parasite stress can influence certain consumer-relevant behaviours, I will cover conspicuous consumption and neophobia more deeply prior to establishing how these could be used to influence consumer behaviours.

Conspicuous Consumption

As mentioned earlier, conspicuous consumption is one strategy by which humans invest resources in an attempt to increase mating success (Saad 2013). The term *conspicuous consumption* was coined by Veblen (1899) and refers to a purchase or non-essential activity that occurs to signal affiliation to a more prestigious social class (Saad 2007). Saad reasons that conspicuous consumption is a form of mate acquisition as the Veblen effect is actually a form of Zahavian signaling (Saad 2007; Sundie et al. 2011). Miller and Todd (1998) argue that for Zahavian signaling to work requires that the sexual signal be too costly to replicate, thus making the signal an honest depiction of a mate's quality. By having a signal too costly for lower quality individuals to imitate, it becomes easier to identify the best quality individuals as prospective mates. This is an important concept as it directly relates to human consumption habits. The reason that the quality of a male is directly related to their ability to invest resources into costly signals is related the theory of an extended phenotype.

The theory of the extended phenotype was originally proposed by Dawkins, using the example of a bowerbird's courtship display (Saad 2007). During the courtship display, in addition to building structures and doing a dance, male Satin bowerbirds display blue and yellow objects that the individuals were able to find (Wojcieszek et al. 2006). The extended phenotype

is the idea that natural and sexual selection can shape life history traits beyond an organism's physiology; instead it can include the resources acquired as well (Saad 2007). In the example provided, sexual selection shapes not only the development of secondary sexual characteristics but, courtship rituals that entail behaviours including resource acquisition as well. This is notable as it relates back to the parasite stress level which could influence alternative life histories.

Considering survival and reproduction are the two key elements to an individual's fitness, a force affecting an individual's mortality may influence the importance of the display of resources like the blue and yellow materials required for the courtship display in the bowerbird. In later work within the marketing discipline, Belk proposed a theory of the extended self whereby people's possessions shape or represent their identities (Belk 1988). Saad (2007) argued that the idea of the extended self is a specific representation of an individual's extended phenotype. If humans use conspicuous consumption as costly mating signals whereby the resources expended to display one's quality, then conspicuous consumption should be viewed as an extension of an individual's phenotype.

Since Veblen's original definition of conspicuous consumption was coined more than a century ago, it is important to properly define the term. *Conspicuous consumption* refers to any type of consumption that is easily observed and evaluated by others that can enhance a person's social status (Chaudhuri et al. 2011). As Saad argues that the products used when conspicuously consuming act as extended phenotypes, it should be expected that the more common types of conspicuous consumption will differ based on sex. The different ways that conspicuous consumption occurs is attributed to the difference in sexual signals between males and females based on their evolutionary history (Buss 1998). Since women tend to provide greater amounts of direct parental care (as compared to men), their mate preference is for a male who will show

greater levels of parental investment and who exhibits a greater willingness to share a larger amount of his acquired resources (Buss 1993). On the other hand, men can increase their fitness through a greater number of mating opportunities. This results in men being more concerned with increasing the genetic advantage of their offspring through better quality female mates as well as increasing genetic diversity (Buss 1998). These sex-specific evolutionary realities lead women to prefer men with higher social status that can share more resources and invest in their offspring whereas men prefer younger and more beautiful women as they have a larger chance of producing more and better-quality offspring (Saad 2007; Buss 1998). If this is the case, there should be sizeable sex differences in the patterns of conspicuous consumption. Considering these preferences, it would be expected that conspicuous consumption used by women to acquire mates would revolve around looking younger and more beautiful. Alternatively, when men use conspicuous consumption as a sexual signal, the driving motive is to signal the highest possible social status. As was touched on earlier, parasite stress theory suggests that an increased perception of parasite stress and vulnerability will drive an increased investment into reproduction, which will likely be exhibited in the form of conspicuous consumption. The difference in how the different sexes exhibit conspicuous consumption is important as it can help guide predictions into how parasite stress can affect consumer behaviours within specific product categories. With the general differences being established as to how the sexes partake in conspicuous consumption, the specific product or service categories affected most can be explored.

In order to more effectively examine how parasite stress theory may affect conspicuous consumption habits, it is crucial that the most effected product and service categories be understood. As re-enforcement regarding the importance of beauty within female conspicuous

consumption, Choa and Schor (1998) found that the more visible female cosmetics were, the less important the quality to price ratio became. This showed that women were willing to spend comparatively more money on cosmetic products that were more visual, pointing to a greater importance being placed on how visual the cosmetics were. O’Cass and McEwen completed a survey with 18 to 25-year-old participants showing empirical evidence that men and women exhibit conspicuous consumption differently (2004). Further proof of the dissimilarity between the consumption habits of men and women is exemplified in the rates of cosmetic surgeries. Cosmetic surgery is used to make clients look younger and/or more attractive. According to Lauzen and Dosier (2002) women had ten times as many cosmetic surgeries as men. To support this, in a more thorough analysis, Saad (2007) found that between 1998 and 2001, women had approximately 90% as many cosmetic surgeries as men with the only two types of surgeries dominated by males being male breast reduction and procedures for male pattern baldness. These studies provide evidence that women’s conspicuous consumption habits are largely driven by the desire to look younger and more attractive. Unlike product categories like beauty and cosmetics, which directly correspond to the traits a woman is attempting to showcase (good genes via beauty and age), men spend more frivolously on ostentatious objects that can increase social status. This theory was supported with an example given on the Mercedes C series; This Mercedes model was meant to target a less affluent consumer but, as the price was low, it was not viewed as a status signal and thus, did not sell in large quantities until the price was raised (Saad 2007). The importance of conspicuous consumption was even shown in poorer, less developed countries that expend resources on social signals. In a study in less developed countries, van Kempen found that many people engage in deceptive signaling (2003). Many drivers would keep their windows rolled up, pretending to have air conditioning in their car,

truck drivers would imitate being on the phone using fake wooden phones, and people would even go to shop in expensive markets, collecting items before finally leaving with nothing (van Kempen 2003 as cited in Saad 2007). In a later study, Van Kempen completed an empirical study in Bolivia highlighting that poor individuals in developing countries are willing to pay for designer labels to help them gain social identity (2004). Considering the costs involved in investing resources on non-essential products for survival, it would seem that the resulting benefits are their use as sexual signals. Fraja (2009) explains that for males, each mating opportunity comes with it a potential negative impact on their survival so, the cost of investing into conspicuous consumption is related to the increased probability of the individual to gain the opportunity to mate. Due to the nature of how males convey their status through conspicuous consumption, the product categories expected to be most affected by increased conspicuous consumption in males would be those that are easily displayed such as luxury cars, fancy clothes, and expensive watches.

These previous works provide a glimpse of a large body of evidence pointing to conspicuous consumption being a form of costly signaling used in acquiring mates. If conspicuous consumption is in fact a sexual signal, it would be interesting to further understand how environmental factors play a role in affecting consumption habits. Although conspicuous consumption can occur cross-culturally, certain geographic or environmental factors could shape the resources which are used as sexual signals. Larger environmental events (natural disasters, war or pandemics, etc.) should be expected to change individual life histories and, thus, the ways conspicuous consumption takes place. For instance, a sizeable blizzard in 1888 caused a large shortage of milk causing prices to soar; this caused men to start ordering milk in bars as a status signal (Saad 2007). Continuing, neophobia will be covered as an exemplar of the Darwinian

module of survival module. Subsequently, an examination of the research on the relationship of the environmental factor of parasite stress to the behaviours of conspicuous consumption and neophobia will be explored.

Neophobia

Unlike conspicuous consumption, neophobia maps onto the survival module. Neophobia is the fear of anything new including food, individuals, situations, geographic areas, ideas etc. (Forss et al. 2017). The reason neophobia is encapsulated within the Darwinian survival module is that it reduces mortality risk by avoiding any risky new scenario (Forss et al. 2017; Brown et al. 2015; Elvidge et al. 2016). Unfortunately, avoiding all novel individuals, foods, and situations also limits an individual's likelihood of finding a new, better fitness outcome. This section showcases how different types of environmental stresses and mortality make it difficult to predict a priori the expected levels of neophobia under parasite stress before ultimately linking neophobia's relevance to consumer behaviour. Several studies have highlighted examples of humans benefitting from having more varied food sources in more turbulent environments, which must have developed from more neophilic populations (Rolls et al. 1981; Kahn and Wansink, 2004; Remick et al. 2009). According to optimal foraging theory, individuals will attempt a foraging strategy that provides the largest net energy reward when considering the energy invested to searching and eating a particular food versus the energy reward from eating said food (Martin 1983). The same can be thought of when expanding to other fitness outcomes like reproductive opportunities. However, behaviours driven by food would likely favour more investment into variety seeking as there is a stronger link to energy benefit and fitness outcome when compared to social interactions. Especially in a less stable environment, populations with a more varied diet would be more likely to overcome a drought or bad hunting season. This

implies that turbulent environments would create a selective pressure favouring variety seeking behaviour with respect to diet. Havermans and Brondel (2012) provide an example of how adding varied foods to a meal inhibits sensory-specific satiety. By adding a variety of foods, an individual is driven to eat a larger portion or meal. A similar preference for varied foods was also seen in Capuchin monkeys wherein they preferred a variety-seeking diet rather than a single preferred food source, demonstrating that variety-seeking behaviour is rooted in our evolutionary history (Addessi et al. 2009). However, despite evidence of the evolutionary benefit to variety seeking diets, there are also examples of populations under higher mortality stresses that have been shown to increase neophobia. Work on Trinidadian guppies has shown that populations under higher predation stress showed more neophobia by exhibiting more risk-averse foraging strategies (Brown et al. 2015; Elvidge et al. 2016). The variability in the adoption of more neophobic behaviour makes it uncertain as to how parasite stress would change behaviour with respect to the survival module. Under which circumstances is neophobia favored more than variety seeking? Prior to discussing how neophobia could influence various consumer-related behaviours, it is important to explore potential factors that could allow for a clearer picture in predicting neophobic behaviours.

In more turbulent environments with high mortality rates, the plasticity of neophobic behaviours can be activated by different drivers of mortality. Previous papers touch on variety seeking behaviour in mates based on perceived resistance to disease or illness. In general, although females' fitness is limited by their reproductive output, it may still be increased genetically by mate quality and diversity (Trivers and Willard 1973; Penn and Potts 1998). In variable and unstable environments, a larger genetic diversity in an individual's offspring allows for a greater reproductive success; this would suggest a multi-mate strategy with novel genes

would be the best approach to having a more diverse set of offspring (Hill et al. 2015). However, there may be a large cost to obtaining mates, especially in environments under high parasitic stress. In such environments, there is a large trade-off between mating with multiple novel mates in an attempt to increase chances of having offspring genetically resistant to prominent disease and the risk of contracting a parasitic disease or infection due to the mating with a novel, unfamiliar mate (Penn and Potts 1998; Reece et al. 2011; Smith and Smith 2012). Hill et al. (2015) conducted a study to examine this trade-off; they found that women who had a history of being more vulnerable to disease preferred a variety of novel mates whereas women who had a history of being less vulnerable to disease preferred fewer mates. It appears that females who seem to not already have a higher genetic resistance to disease and illness are more willing to risk infection through novel unfamiliar mates as they may have less to lose. The inconsistency in how neophobic behaviour reacts to stressful environmental forces makes for an interesting stream of research within consumer behaviour. Given that neophobia is the avoidance of anything new, it is likely that neophobia could affect the rate of product adoption as well as changing of brands. Considering neophobia's potential effect on consumer behaviour, having more granular predictions as to how parasite stress will affect neophobia could have implications for rate of product adoption, geographic marketing strategies and, product development for specific geographic regions. As neophobia and conspicuous consumption are working in different ways to protect against elevated perceived parasite stress levels, the theoretical background has provided a guide leading to this paper's hypotheses to which I turn next. Following the hypotheses, the paper will test the changes in behaviour caused by parasite stress act as a behavioural immune response. Based on the results, assumptions can be drawn on how parasite stress theory may act on consumer behaviours.

Hypotheses

Many consumer-related behaviours and phenomena are likely affected by parasite stress across different ecological settings. More specifically, an increased perceived vulnerability to parasitic and infectious disease should lead to an increase in conspicuous consumption. As previously mentioned, this change in behaviour is predicted to occur as people living in an area with perceived higher mortality rates will invest more, and earlier into reproductive efforts. Furthermore, perceived vulnerability is predicted to also affect levels of neophobia. To re-iterate, there is conflicting literature which provides evidence that there is an anticipated change in neophobic behaviour but, the direction cannot be predicted. The change in neophobic behaviour is predicted as people from areas with a higher perceived mortality will decide which resources are worth sacrificing for the larger likelihood of survival. Echoing the earlier theoretical background, conspicuous consumption was chosen as a representation of the Darwinian module of reproductive whereas neophobia was chosen to represent the survival module. If the posited hypotheses are supported, it can play a role in predicting certain consumer behaviours such as targeted marketing for specific product categories like fashion, beauty, automotive etc. based on environmental factors like parasite stress. Furthermore, if the hypotheses hold true, the research can provide insights into new product adoption rates and brand switching behaviour, especially among different product categories. This could help any type of geographic marketing strategy moving forward whether it be targeted advertising, anticipated product adoption, or new product development. Furthermore, this research seeks to re-enforce the importance that evolutionary psychology can have in the world of consumer behaviour.

As I put forward the hypotheses, it is important to consider that because selective pressures will act on anything that can affect fitness, a difference in parasite stress levels should be expected to affect any behaviours that influences survival as well as fecundity. As mentioned previously, it has already been shown that more unstable and stressful environments can lead to changes in the mating system (Low 1990). Since parasite stress can bring instability and stress to an area, it is possible that increased parasite stress could alter the local mating system. Multiple studies discussed earlier have shown that when there is a higher adult mortality, animals tend to allocate more energy and resources to mating earlier (Tinkle and Ballinger 1972; Reznick and Endler 1982). Furthermore, in unpredictable and more stressful environments, females are choosier, thus putting an emphasis on the importance of signaling male quality (Low 1990). So, an increase in parasite level should emphasize a greater importance to display resources for males and beauty or youth for females. Recall that since conspicuous consumption can be a form of Zahavian signalling, it can be used in this study as a measure of the level of investment into mating (Saad 2007; Sundie et al. 2011). Despite establishing earlier that the two sexes exhibit conspicuous consumption in different ways, the questionnaires did not specify any type of product category and thereby did not require sex-specific hypotheses or analyses. Additionally, despite a clear preference for variety-seeking behaviour in unstable environments, it is unclear how exactly environmental stresses affect neophobia (Rolls et al. 1981; Kahn and Wansink, 2004; Hill et al. 2015). As previously mentioned, some studies focusing on food have shown variety-seeking diets to be an evolutionary adaptation (Rolls et al. 1981; Kahn and Wansink, 2004; Remick et al. 2009). However, there has also been work directly showing greater levels of neophobia in guppies when in areas of higher predation (Brown 2015; Eldvidge 2016). Hill et al. (2015) have even shown that women's preference towards a variety of novel partners was

influenced by their vulnerability to disease and illness. Unfortunately, the lack of unifying theory results in an uncertain neophobic consequence when individuals are faced with environmental stresses. Using this theoretical background, the following hypotheses are posited:

H1a: Visual stimuli of people with visible symptoms of illness will increase the perceived vulnerability to disease.

H1b: Visual stimuli of people with visible symptoms of illness will increase conspicuous consumption.

H1c: Visual stimuli of people with visible symptoms of illness will alter levels of neophobia, in any direction

Following the initial hypotheses, two more were made to expand the theory to make cross-cultural predictions.

H2a: An increase in parasite stress level will result in an increase in conspicuous consumption

H2b: An increase in parasite stress level will have an affect on levels of neophobia in any direction

Methods

This study seeks to prove that perceived vulnerability to parasitic and infectious disease could alter certain consumer behaviours, particularly conspicuous consumption and neophobia. In doing so, it will re-enforce the role of evolutionary psychology in understanding decision making and consumer behaviour. As the paper attempts to find not only if the link is found across geographic areas of differing parasite stress levels but also strives to show how behaviour

can be manipulated, both a cross-cultural survey and an experiment had to be completed. A pilot study was conducted to establish the efficacy of potential visual and audio primes to be used in the experiment. The experiment was conducted to demonstrate if a priming effect could influence an individual's perceived vulnerability and thereby their behaviours. The cross-cultural survey was completed to gauge the naturally occurring strength of the relationship between perceived vulnerability to levels of conspicuous consumption and neophobia across cultures. This section will dive more deeply into the methodology of each part of the experiment and cross-cultural survey.

Pilot test:

A pilot test was conducted to validate if the visual primes from Schaller et al. (2010)'s study were effective in increasing perceived vulnerability to parasitic and infectious disease in participants. In the previous study, individuals who were shown pictures depicting visual symptoms of infectious disease exhibited white blood cells producing higher levels of cytokine interleukin-6 (IL-6) which is a commonly used indicator of immunological response (Schaller et al. 2010) The current pilot study seeks to test the effectiveness of the visual primes by testing across six groups of treatment/control levels. The visual primes used were the same as those used in Schaller et al. (2010) which included men holding guns towards the screen as a control as well as people with visual symptoms of infections or disease for the treatment (see Appendix A). To test for the priming effect that caused the largest increased perceived vulnerability for the treatment compared to the control several levels of treatments and controls were tested. Regardless of the level of treatment (depicted in figure 1), the only difference between the treatment and the corresponding control was the difference of pictures (visual symptoms of illness versus men with guns). The different levels of treatments tested were: a) visual primes

only; b) visual primes with a context question asking the participants what they saw and how it made them feel; and, c) visual primes with associated sounds (gun shots or coughing depending on control or treatment) followed by the context question (see Figure 1). In total, there were 185 participants, of which, 22 did not finish the survey or failed the attention check which led to their data being removed. The remaining 163 responses were analyzed using Minitab. Participants were paid \$0.20 for the completion of the survey through Amazon MTURK. The survey was distributed in the United States (n=163; 79 female, 84 male). During the short survey, participants viewed the visual cues then completed a 23-item questionnaire. This included the 14-item perceived vulnerability to disease scale from Duncan, Schaller and Park (2009) along with an attention check and demographic questions.

Figure 1

Control	Treatment
Visual cues, no context	Visual cues, no context
Visual cues with context question	Visual cues with context question
Visual cues with audio and context question	Visual cues with audio and context question

To test which level of priming caused the greatest difference of perceived vulnerability to parasitic and infectious disease, the dependent variable, perceived vulnerability along with its two subcomponents, perceived infectability and germ aversion were compared within each level of treatment. The subcomponents were analyzed as dependent variables as well as they load onto two very different factors (Duncan et al. 2009). The subcomponent of perceived infectability measures an individual's perception of infection and future health whereas germ aversion is a disgust sensitivity to situations that may result in disease transmission (Duncan et al. 2009).

As perceived vulnerability, perceived infectibility, and germ aversion were found to be non-normal ($P < 0.05$), a Kruskal-Wallis test was conducted to compare the means with all the treatment and control groups. The Kruskal-Wallis test revealed that none of perceived vulnerability, perceived infectibility, and germ aversion showed a significant difference between treatment groups ($p = 0.097$, $p = 0.094$, $p = 0.372$ respectively). This is not surprising as this was testing the significance across 6 treatment or control types. The test did reveal that the treatment and control group with the largest difference of medians was the visual cues with context question (Control Z-value = -1.61 vs Treatment Z-value = +2.33). The Kruskal-Wallis test can be found in Appendix B.

Based on the Z values from the Kruskal-Wallis test, the significance of treatment of visual cues with a context question was tested using a one-way ANOVA to test for perceived vulnerability, perceived infectibility, and germ aversion. The ANOVA revealed no significant difference among treatments for germ aversion ($p = 0.073$) but, found that both perceived vulnerability and perceived infectability were significantly different between treatment and control ($p = 0.002$ Mean C:3.55 vs T:4.35 and $p = 0.021$ Mean C:3.08 vs T:4.03, Appendix B). This result confirms that visual cues with a context question is the best way to prime participants to have an increase in perceived vulnerability to parasitic and infectious disease. Using this priming, an experiment was able to be conducted whereby certain consumer behaviours including conspicuous consumption, general neophobia, food neophobia and variety seeking could be linked to perceived vulnerability.

Experiment:

The goal of the experiment is to test whether people's behaviour can be influenced by visual cues, in particular, visual indicators of illness. As the pilot study showed that visual cues,

paired with a context question significantly increased perceived infectability, the experiment will explore how priming could influence consumer behaviours, particularly conspicuous consumption and neophobia.

Based on the pilot study, the experimental primes used the visual cues with a context question asking participants what they saw and how it made them feel. Five hundred and forty-nine participants from the United States and Canada began the experiment through Amazon MTURK, 24 of which either did not complete the questionnaire or failed the attention check. The data from the remaining 525 participants was analyzed using Minitab. The participants fell into two groups, the control (n= 256; 114 female, 140 male, 2 other) and the treatment group (n= 269; 109 female, 156 male, 4 other). The experiment included five main scales: 1) the 14-item perceived vulnerability to disease scale measuring levels of perceived vulnerability (Duncan et al. 2009); 2) an 8-item general neophobia scale which measured general neophobia related to social situations (Pliner and Hobden 1992); 3) The 10-item food neophobia scale, which measures neophobia specifically related to food (Pliner and Hobden 1992); 4) an 8-item variety seeking scale to measure variety seeking behaviour (Van Trip and Steenkamp 1992). The variety seeking scale was used as variety seeking behaviour tends to be more limited as neophobia increases (Damsbo-Svendsen et al. 2017). Adding this scale would allow for additional depth to the analysis on neophobia. Finally, there was an 11-item conspicuous consumption orientation scale used to calculate an individual's level of conspicuous consumption (Chaudhuri et al. 2011). All scales can be found in Appendix C. The experiment was distributed in two rounds; in the first distribution, the 405 participants answered a 46-item questionnaire after having been exposed to visual primes with a context question. These items included the scales for perceived vulnerability, general neophobia, food neophobia, and variety seeking, one attention check, and

five demographic questions. The scale for conspicuous consumption was left out of the first distribution due to a technical issue during survey distribution. In the second distribution of the experiment, the 120 additional participants followed the same procedure except, the questionnaire consisted of 57 items, which included all the previous items as well as the 11-item conspicuous consumption orientation scale. Participants received \$1.50 for completion of the experiment across both distributions.

Cross-Cultural Survey:

Whereas the experiment attempts to identify how parasite stress theory can be applied in a consumer behaviour on an individual level (via the use of visual primes), the cross-cultural survey aims to establish a correlation between parasite stress levels (across cultural ecosystems) and conspicuous consumption and neophobia.

The cross-cultural survey was distributed via Amazon MTURK in several rounds to ensure a heterogeneous set of countries. In total, there were responses from 21 countries although, 89% of the responses came from four countries (United States, India, Brazil, and United Kingdom). In total there were 421 participants, 15 of which either did not complete the survey or failed the attention check. The attention check consisted of one question asking participants to select a specific answer to validate that they are properly reading and responding to all items (See Appendix C). The remaining 406 responses were analyzed using Minitab. Parasite stress levels of each country was obtained by using the population-adjusted infectious disease disability-adjusted life years (DALY) per 100,000 population as per previous work on parasite stress theory (Thornhill and Fincher 2012). The DALY metric is a measure of disease burden understood as the number of years lost on average due to illness, disability, or early death

caused by infectious disease (www.who.int). The cross-cultural survey distributed included the same five scales used in the experimental study.

In the first distribution of the survey, 95 participants were asked to complete a 43-item questionnaire. This included scales for general neophobia scale, food neophobia scale, variety seeking scale, conspicuous consumption orientation scale, one attention check, and five demographic questions (Pilner and Hobden 1992; Van Trip and Steenkamp 1992; Chaudhuri et al. 2011). In the remaining distributions of the survey, 311 participants completed a 57-item questionnaire, which was the same as the first survey but included the addition 14-item perceived vulnerability to disease scale (Duncan et al. 2009). This scale was added following the first round of distribution as there was a technical issue during distribution preventing the scale from being included in the first round of distribution. Participants received \$0.75 for the completion of the survey across all rounds (n= 406, 130 female, 276 male).

Results

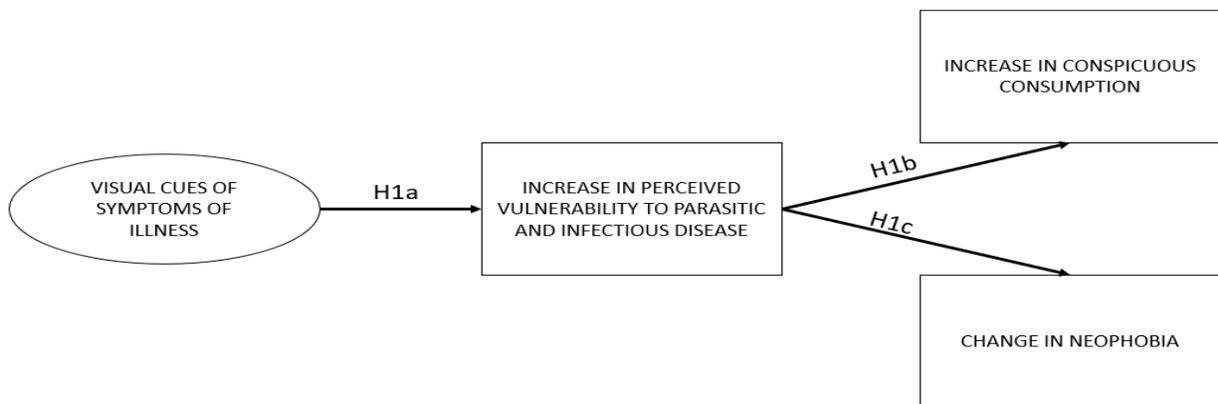
Experiment:

The results of the pilot study confirmed the ability to use the visual cues along with a context question as it showed both perceived vulnerability and perceived infectability to both be significantly different from control group to treatment ($p = 0.002$ and $p = 0.021$ respectively). The result of the pilot test supports hypothesis H1a, that the stimuli of people with visible symptoms of illness will increase the perceived vulnerability to disease. In order to test hypotheses H1b and H1c, that visual stimuli of people with visible symptoms will increase conspicuous consumption and alter levels of neophobia, a sample T-test was conducted for each dependent variable. The T-tests determined that none of the dependent variables were

significantly different between treatment and the control including conspicuous consumption ($p = 0.98$), general neophobia, ($p = 0.24$), food neophobia ($p = 0.54$) and, variety seeking behaviour ($p = 0.41$). This illustrates a failure of both hypotheses H1b and H1c as the visual cues, along with the context question did not generate a significant change in behaviour. The statistical details are provided in Appendix D.

As H1b and H1c were rejected for all four dependent variables, a deeper dive into the reason why this occurred is required. Across all variables, the prime treatment group showed no difference in behaviours as compared to the control group so, I checked if the priming treatments caused a difference in the perceived vulnerability scale. The reason for this is because hypotheses H1b and H1c, which predict that visual cues will increase conspicuous consumption and alter neophobia rely on the assumption that hypothesis H1a, namely that visual stimuli of visible symptoms of illness will increase vulnerability to disease (Figure 2).

Figure 2



As the experimental survey included the perceived vulnerability to parasitic and infectious disease scale, a more robust analysis was carried out using the larger sample size ($n = 405$). A T-test comparing the means of perceived vulnerability for the treatment and control

group showed no significant difference ($p = 0.573$). This indicated the failure of hypothesis H1a, that visual stimuli of people with visual symptoms of illness would increase perceived vulnerability.

Given that hypotheses H1b and H1c were rejected due to the rejection of H1a, I conducted an analysis to understand if the perceived vulnerability to disease could influence a change in behaviours, specifically conspicuous consumption and neophobia. This analysis will act as a more controlled replication analysis of the findings in the cross-cultural survey. A series of simple regression analyses were conducted to compare perceived vulnerability to each dependent variable conspicuous consumption, general neophobia, food neophobia and, variety seeking behaviour. Of the four dependent variables, variety seeking behaviour was the only one found to be not significant ($p = 0.968$). Conspicuous consumption ($r = 0.31, p = 0.031$), general neophobia ($r = 0.49, p = 0.000$) and, food neophobia ($r = 0.20, p = 0.002$) were all found to be significantly positively correlated to perceived vulnerability to parasitic and infectious disease (Appendix D). Firstly, this indicates that the failure of H1b and H1c, that conspicuous consumption and neophobia could be influenced by visual cues of visible symptoms of illness, were caused by the lack of effectiveness of the visual primes in the tested population. Variety seeking having no significant result is somewhat surprising as variety seeking is thought to be limited as neophobia increases (Damsbo-Svendsen et al. 2017). Secondly, this provides proof that, in theory, behaviours such as neophobia and conspicuous consumption can be influenced by perceived vulnerability. This theory was further tested in the cross-cultural survey study. To summarize, three of the four dependent variables were found to be correlated to perceived vulnerability to disease albeit the visual prime was largely insignificant, namely the prime appeared to fail.

Cross Cultural Survey

As opposed to the experimental study which sought to understand if behaviours could be influenced by priming the participants, the cross-cultural study intends to show that cultures exhibit a difference in conspicuous consumption and neophobia based on increased parasite stress. This would demonstrate that ecological variables of evolutionary importance have an effect on aggregate consumption patterns at the cultural level. The analyses in the study will test the hypotheses that an increase in parasite stress level will result in increased conspicuous consumption (H2a) and it will have an affect on the levels of neophobia (H2b). To accomplish this, a stepwise regression analysis was conducted to determine which DALY variable to use in order to have the strongest result while eliminating multicollinearity. The four DALY scores were compared to find which of the four was the strongest predictor of perceived vulnerability. The stepwise regression analysis was completed comparing all four types of disability-adjusted life years (DALY) scores with perceived vulnerability to identify the best suited DALY variable by eliminating non-significant correlations of perceived vulnerability and highlighting multicollinearity. The stepwise regression used a forward selection process an alpha of 0.15 to enter. The four DALY scores tested were the general DALY for place of birth, the general DALY in current country, the parasite DALY for place of birth and, the parasite DALY for current country. The regression indicated a relationship between perceived vulnerability and both types of parasite DALY scores, birth country and current country (Appendix E). This indicated that the parasite DALY scores were better predictors to perceived vulnerability perhaps because they are a subset of the general DALY dealing particularly with parasitic and infectious disease. Even though both the parasite DALY in current country ($p = 0.016$) and parasite DALY in birth country ($p = 0.071$) variables were found to be significant, only the parasite DALY in current

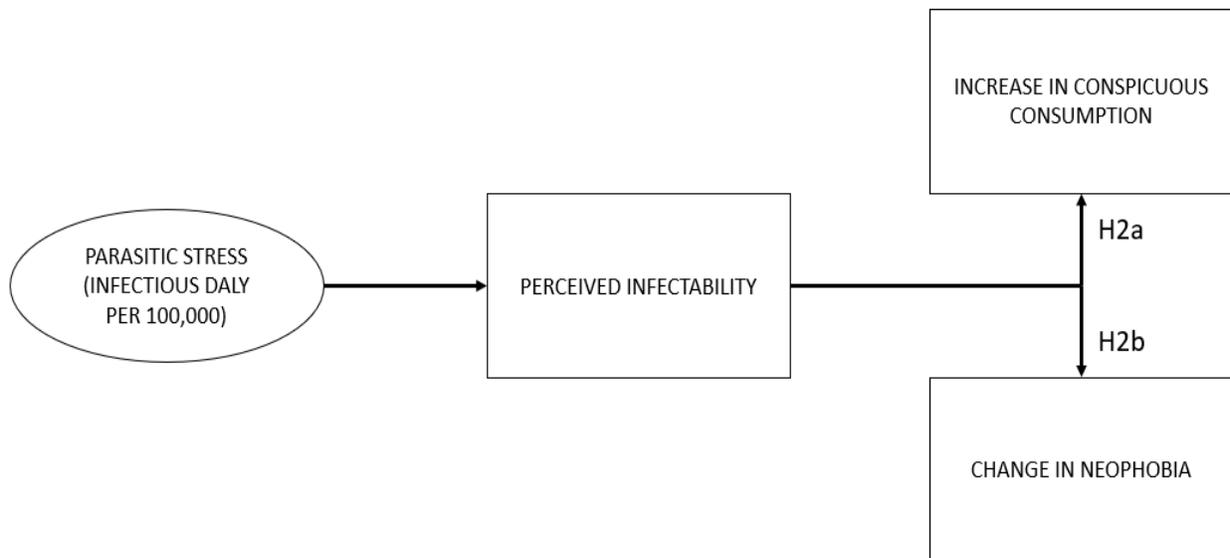
country was used as a predictor for hypothesis testing of the cross-cultural survey. The parasite and infectious disease DALY per 100,000 people in the current country was used as the sole predictor for the hypotheses testing because there was moderate multicollinearity ($VIF= 2.32$) between the parasite DALYs and the current country DALY variable showed the strongest significance ($p =0.016$).

To test hypotheses H2a and H2b, that parasite stress levels could affect both conspicuous consumption and neophobia, several simple regressions were completed to measure the impact that the infectious DALY per 100,000 has on conspicuous consumption, general neophobia, food neophobia, and variety seeking behaviour. The results of the regressions yielded significant correlations for all variables with the infectious DALY per 100,000: conspicuous consumption ($r=0.26, p = 0.000$), general neophobia ($r=0.15, p = 0.000$), food neophobia ($r= 0.06, p = 0.005$), and variety seeking behaviour ($r=-0.09, p = 0.000$). This provides support to the hypotheses H2a, an increase in parasite stress will increase conspicuous consumption as well as H2b, an increase in parasite stress will affect neophobia. Furthermore, the significant negative correlation between parasite stress and variety seeking behaviour is aligned with the findings on neophobia, that as parasite stress increases, people are less likely to exhibit variety seeking behaviours. All statistical analyses completed for the cross-cultural study can be found in Appendix E.

A simple regression was conducted between the infectious disease DALY per 100,000 and perceived vulnerability to ensure that the DALY metric was an accurate representation of perceived vulnerability. Surprisingly, the simple regression revealed that the infectious disease DALY per 100,000 was not significantly correlated to perceived vulnerability. As this result does not align with the hypothesis and the stepwise regression model with a larger alpha, the relationship was evaluated more in depth. Another simple regression was conducted to

understand the relationship between the infectious DALY per 100,000 and perceived infectability, a subcomponent of perceived vulnerability. Since this subcomponent is the specific component that measures an individual's perception of infection and future health rather than total perceived vulnerability including germ aversion, it should be the strongest correlated subcomponent to infectious DALY per 100,000. The regression revealed a significant correlation ($r= 0.07, p = 0.003$) between the infectious DALY per 100,000 and perceived infectability. This suggests that the specific mechanism that causes parasite stress levels to affect conspicuous consumption and neophobia are driven through the subcomponent, perceived infectability, not through perceived vulnerability (Figure 3).

Figure 3



Discussion

The general finding of both the experiment and cross-cultural survey was that perceived vulnerability is positively correlated to behaviours that represent the two Darwinian modules of survival and reproduction. More specifically, when individuals have a higher perceived likelihood of contracting parasitic/infectious disease, they tend to exhibit more conspicuous consumption and neophobia. Furthermore, the parasitic and infectious disease disability-adjusted life years (DALY) per 100,000 was positively correlated with perceived infectability. This demonstrated that populations living in areas of higher parasitic and infectious disease stresses would be more likely to exhibit conspicuous consumption and neophobia. Finally, even though the pilot test, along with earlier work by Schaller et al (2010) demonstrated that visual cues could influence perceived vulnerability to disease, the experimental study failed to show a difference in perceived vulnerability based on different visual cues. The lack of effectiveness in visual primes led to a lack of significant correlation between the priming treatments and the consumption behaviours being measured.

Experimental study

The experimental study was unable to establish a causal link between visual primes of visible symptoms of illness to a change in consumption behaviour, leading to the rejection of H1a, that visual stimuli will increase perceived vulnerability to disease. The rejection of H1a thereby also led to the rejection of hypothesis H1b and H1c, that visual primes would lead to an increase in conspicuous consumption and a change in neophobia. Hypothesis H1b and H1c were both founded based on previous literature which documented that visual stimuli elicited biological immune responses which infers that the stimuli should cause behavioural changes as well. (Miller and Maner 2011; Schaller and Park 2011; Murray and Schaller 2016). However,

hypotheses H1b and H1c were posited under the assumption that hypothesis H1a, namely that visual stimuli will increase perceived vulnerability to disease, is supported. However, because H1a was refuted, it stands to reason that H1b and H1c would fail as well. The initial pilot test replicated a study by Schaller et al. (2010), which validated that visual primes of individuals with visible symptoms of illness, accompanied by a context question, significantly increased perceived vulnerability to disease when comparing the treatment group compared to control group. However, during the full experimental study, the treatment group did not significantly differ in perceived vulnerability from the control group ($p = 0.57$). The full data from the experiment led to the rejection of hypothesis H1a despite promising results from the pilot study. The idea behind the hypotheses that the visual primes would result in differing levels of consumption and neophobia is reliant on the visual cues changing participants' perceived vulnerability to disease. One reason this effect may have failed was because the behavioural changes were being measured using a general trait level scale that captures one's stable disposition on that trait whereas the experimental manipulation was situational. Using a situational response as opposed to the self-reported dispositional scales may have resulted in lesser bias and hence might have augmented the possibility of picking up the hypothesized effect. As the attempted priming did not significantly change perceived vulnerability, it is understandable that the behaviours did not significantly change as well. The lack of replicability of the priming effect is not very surprising considering that priming studies and statistical methods used by psychologists to support hypotheses have been called into question as many priming studies have not been able to replicate due to how easy they are to gain statistical significance (Simmons et al. 2011; Chivers 2019).

To further investigate, I analyzed the experimental data using perceived vulnerability rather than the primed and control group. Using a regression analysis, perceived vulnerability did have a positive effect on conspicuous consumption ($r= 0.31, p =0.031$) and neophobia (general neophobia: $r= 0.49, p = 0.000$; food neophobia: $r= 0.19 p =0.000$). The results of the analysis between perceived vulnerability to disease and the measured behaviours reinforced what was found in the cross-cultural study. Firstly, conspicuous consumption had a positive correlation to perceived vulnerability. The stronger the perception of vulnerability participants had, the stronger their proclivity for conspicuous consumption. Though the priming effect failed, the positive correlation between conspicuous consumption and perceived vulnerability is in line with the theory explored earlier in this paper. As conspicuous consumption can be viewed as a form of costly signaling, it would be expected that individuals with a higher perceived vulnerability to disease would be more likely to engage in conspicuous consumption (Miller and Todd 1988; Saad 2007; Sundie et al. 2011). Secondly, the experimental study also exhibited a positive correlation between general neophobia and perceived vulnerability. Note though, that food neophobia displayed a much weaker positive correlation and the variety seeking behaviour was shown to have a weak negative correlation. The difference between general neophobia and food neophobia highlights that the type of resource, whether it be social interactions, food, wealth, etc., may act as a moderator in determining the scale of neophobic behaviours under parasite stress. This may also offer an explanation as to why variety seeking behaviour was not significantly different across groups. The items making up the scale for variety seeking were related to food; if instead variety seeking was measured by social interaction (finding new partners, making friends, travelling, etc.), it may have yielded a more significant result. This all suggests that, as a resource, food specifically is more important than social interaction. Given

that the neophobic behaviour most affected in this study was neophobia based around social interactions (from the general neophobia scale), it follows the theory that suggests that the behavioural immune system uses anti-parasitic psychology and behaviour as a means to protect or manage the risk of parasitic and infectious disease to individuals (Faulkner et al. 2004; Navarrete and Fessler 2006; Fincher and Thornhill 2012). This study reinforces findings from Fincher and Thornhill (2012)'s parasite stress theory which links assortative sociality behaviours to parasite stress levels.

The experimental study provided insights into the ability to influence certain consumer behaviours using visual cues. Despite earlier cited works and the success stemming from the pilot study, the full experiment failed to provide evidence that visual cues of individuals with visible symptoms of illness could affect perceived vulnerability to disease. Due to the lack of influence on perceived vulnerability, the experiment also failed to show that the visual prime could alter conspicuous consumption and neophobia. However, using the data from the experiment, a positive link between perceived vulnerability and both conspicuous consumption and neophobia was documented. Perceived vulnerability to disease was shown to be positively correlated with conspicuous consumption as well as general neophobia.

Cross-cultural study

The cross-cultural study yielded a positive correlation between parasitic DALY per 100,000 and both the behaviours of conspicuous consumption and general neophobia. The analysis also yielded a weak positive correlation to food neophobia and negative correlation to variety seeking behaviour. In areas of higher parasitic and infectious disease, the population will tend to engage in higher levels of conspicuous consumption ($r= 0.26$) mirroring predictions from earlier work on parasite stress theory (Fincher and Thornhill 2012). This finding strengthens the

idea that conspicuous consumption is a form of Zahavian signaling (Miller and Todd 1988; Saad 2007; Sundie et al. 2011). The result of the study confirms H2a, that an increase in parasite stress would lead to an increase in levels of conspicuous consumption. In areas of higher parasitic and infectious disease stressors, men place greater emphasis on conspicuous consumption to increase their apparent social status (Saad 2007; Chaudhuri et al. 2011). On the other hand, it would be expected that in such locations, women would be more invested into consumption habits that would increase their perceived beauty (Saad 2007; Kalb 2009; as cited by Lauzen and Dosier 2002). This would imply that in areas of higher parasite stress, it is expected that men are more likely to invest in products that can elevate their perceived social status whereas women would invest more heavily in goods and services related to their physical appearance (e.g., as per the beauty industry).

The results from the cross-cultural survey confirmed hypothesis H2b: that an increase in parasite stress levels will have an effect on neophobia. Though neophobia showed a positive correlation to parasitic and infectious disease DALY per 100,000, as seen in the experimental study, there was a difference in correlation strength based on the types of neophobia. General neophobia yielded a positive correlation to parasite stress ($r=0.15, p = 0.000$) but, food neophobia yielded a smaller effect food neophobia ($r= 0.06, p = 0.005$). Furthermore, variety seeking was shown to have a weak negative correlation to parasite stress ($r= -0.09, p = 0.000$). As eluded to previously during the discussion on the experiment, difference in the type of neophobia and decrease of variety seeking behaviour may explain some of the inconsistencies in the previous literature on neophobia. In previous work, it has been highlighted that in more unstable, turbulent environments, there was an emphasis placed on variety seeking behaviour (Rolls et al. 1981; Kahn and Wansink, 2004; Remick et al., 2009). However, much of the variety

seeking behaviour literature is observed with variety of food sources (Adessi et al. 2009; Havermans and Brondel 2012). Trade-offs in neophobia and variety seeking behaviour are strictly between obtaining resources and potential reduced life expectancy. For instance, when studying the foraging behaviours Trinidadian guppies, in higher predation areas individuals exhibited more risk-averse foraging strategies (Brown et al. 2015, Elvridge et al. 2016). As searching for new resources in areas of heavier parasite and infectious disease stress could lead to a negative impact on survival, it stands to reason that the acquisition of new resources should outweigh the negative impacts of the variety seeking behaviour (Forss et al. 2017, Brown et al. 2015; Elvridge 2016). The difference in the strength of correlation to parasite stress between general neophobia and food neophobia provides evidence supporting that certain resources are less reactive to environmental factors than others. As the food neophobia scale implies, the scale measure neophobic tendencies with respect to food whereas the general neophobia scale's items all directly related to social interactions. Again, because food neophobia has a weaker correlation to parasite stress levels than general neophobia, it implies that food is a more important resource that warrants taking greater risk to acquire in comparison to meeting new potential mates as the general neophobia scale relates to social interaction. Furthermore, if general neophobia was positively correlated to parasitic stress, one would expect variety seeking behaviour to be negatively correlated to parasitic stress. To re-iterate, when evaluating the questions from the variety seeking scale, all questions were linked to variety seeking behaviour with respect to food. Since the food neophobia correlation to parasite stress was much weaker than the general neophobia scale, it is plausible that resources, such as food, act as a moderator to the relationship between parasite stress and neophobic behaviour. The differential correlation of general neophobia and food neophobia to parasite stress suggests that in environments with higher

parasitic and infectious diseases, it may prove more difficult to introduce new goods and services (as this serves as a proxy of risk-taking behaviour). Further testing of the moderating effects from specific product categories would be interesting as certain product categories, such as food, may not suffer from neophobic behaviours as much as others.

The results of the cross-cultural study provides evidence that parasite stress theory can be applied to understanding and predicting consumer behaviour. Specifically, levels of conspicuous consumption and general neophobia could be predicted based on the parasite and infectious disease prominence in certain populations. Furthermore, the study provides compelling justification for additional studies of parasite stress and, more broadly, evolutionary psychology in the field of consumer behaviour.

Limitations

Several factors caused limitations to both studies as relating to data collection and the timing of the studies. Firstly, due to the COVID-19 pandemic, data collection for the experiment was conducted via Amazon MTURK. The preference from a research perspective would have been in-person experimentation as to reduce potential confounding variables like language barriers and to ensure full attention was provided to the study by the participants. However, research has revealed that MTURK reliability is no less reliable from previously reported community samples including college campuses, and that, with the addition of an attention check item, there was a strengthening in the reliability of responses (Rouse 2015). Using online participants may have played a role in the failure to replicate a change in behaviour that was seen in previous work (Schaller et al. 2010). To mitigate the risk of potential lack of attention issues, an attention check question was added to each survey in both studies leading to 46 attention

failures. As a result, these 46 data points were removed from all subsequent analyses accounting for 4.86% of total participants. Another limitation of the study was that the method to measure behavioural changes in conspicuous consumption and neophobia were done using trait level self-reported scales. This method could introduce a potential bias in the response. Instead, for future potential research, using situational responses could remove the response bias leading to a potentially more accurate measure of behaviour. A third limitation of the study was the potential bias across all participants, as the current study included the measure of perceived vulnerability to infectious disease during the COVID-19 pandemic. Due to potentially strong feelings regarding the current pandemic, participants may have been skewed to have a high baseline perceived vulnerability. In order to address this potential confound, throughout every step of the data collection for the study, I used the perceived vulnerability to disease (PVD) scale to keep a measure of the sample's baseline scores. This will allow future research to compare or adjust scores in future data collection (in the post-COVID era) compared to the average control group scores.

Future research

The current findings offer several avenues for future research. Firstly, the phenomena explored in this research could be more robustly explained with longitudinal data. Using historical trends rather than surveys and experiments will yield actual field data on consumption trends rather than self-reported preferences. This research could be achieved in two ways; firstly, scanner data might be used from 2002 to 2004, which corresponds to the spread of the SARS virus. Data used would be for select product categories representing conspicuous consumption. To go even further, if accurate data exists on brand switching/loyalty and/or timelines of the diffusion of innovation curve, research could find historical links of parasite stress levels to

neophobic consumer behaviours. Doing so would allow an analysis of potential consumer behaviours driven by the spread of the SARS virus. Secondly, due to baseline perceived vulnerability data collected during multiple stages of the COVID-19 pandemic, perceived vulnerability to disease can continue to be captured every 6 to 12 months to allow for comparison with consumer behaviours during and following the pandemic. By using longitudinal data of perceived vulnerability along with scanner data on consumption habits, researchers will be able to track how consumption habits changed over time and with relation to perceived vulnerability.

Another stream of research that can be conducted is the type of stimuli that can alter behaviours. It has already been shown that olfaction can play a role in buying premium brands so, it stands to reason that there is the potential of other stimuli, beyond purely visual, affecting both consumption and neophobia (Madzharov et al. 2015). Stimuli like the smell of hand sanitizer or mold as well as auditory cues like coughing or sneezing may influence consumer behaviours associated with Darwinian modules like conspicuous consumption or new product adoption. Building off of the moderators potentially affecting behaviour, future research would benefit from understanding which consumer behaviours could be directly influenced. For instance, building a greater knowledge on parasite stress's affect on brand switching, brand loyalty, diffusion of innovation curve for new product adoption could provide more specific and practical uses of neophobic behaviours for marketers.

The last stream of research that may arise from the current study is the further development into the moderators of the correlations found in the current study. For instance, exploring which product categories most and least affect neophobia in high parasite stress will allow for a clearer picture of the phenomena to emerge. This study has already shown that

neophobia related to food has a smaller effect than social interactions potentially indicating that the product category of food moderates the correlation of parasite stress and neophobia. Which other product categories or resources like wealth may act as moderators? Furthermore, at what price point does a specific product become an honest signal, to be used in conspicuous consumption? Understanding more granular details about the correlations between parasite stress and behaviours found in this study will allow for new practical and theoretical venues for the use of parasite stress theory within the marketing realm.

Conclusion

This study sought to identify how parasite stress levels affect consumer-related phenomena. This was accomplished by building off of the parasite-stress theory (Thornhill and Fincher 2012), to study how parasite stress influences the Darwinian modules of survival and reproduction. Conspicuous consumption was chosen as the exemplar from the reproduction module; it was proven that conspicuous consumption does increase as the perceived vulnerability to disease increases. This is in line with predictions made, showcasing that the behavioural immune system attempts to maximize mating opportunities in a less stable environment with higher potential mortality. Despite this, the experiment failed to establish a change in behaviour using visual cues of individuals with visible symptoms of illness albeit it did provide proof that individuals with higher perceived vulnerability have a greater proclivity for conspicuous consumption. The cross-cultural survey went on to highlight the fact that populations in areas of larger parasitic and infectious disease levels tended to have increased conspicuous consumption habits.

Neophobia was also tested as it served as the exemplar of the Darwinian module of survival. General neophobia increased as perceived vulnerability to disease increased. Though a similar trend was found for food-specific neophobia, the effect of perceived vulnerability was smaller, indicating that food may act as a potential moderator of the larger effect. Since neophobia represents the trade-off between finding new resources to increase an individual's fitness and the increased likelihood of coming across a novel parasite or disease, it would seem that the type of resource being evaluated for neophobia makes a difference in the effect size on behaviour from parasite stress. As previously mentioned, the evidence from this study suggests that food sources are less elastic with respect to neophobia as opposed to other resources like social interaction and thereby mating opportunities. Similar to what was seen with conspicuous consumption, the experiment failed to provide evidence that neophobia could be influenced by visual cues though, to re-iterate, it proved that perceived vulnerability did increase neophobia. Despite the inability to influence neophobia through visual priming, the cross-cultural survey found that parasite stress levels from individuals' current country of residence influenced levels of general neophobia as well as food neophobia on a smaller scale. However, the cross-cultural study did reveal that the parasite stress levels of current countries of habitation influenced behaviour via perceived infectability, a sub-component of perceived vulnerability related to the likelihood of infection.

To summarize, the behavioural immune system alters behaviours associated with the Darwinian modules of survival (neophobia) and reproduction (conspicuous consumption). This offers the first compelling evidence of how evolutionarily-relevant environmental contingencies (such as parasite stress levels) can have a profound effect in consumer and marketing-related settings.

Table 1.

	Hypothesis	Key finding
H1a	Visual stimuli of people with visible symptoms of illness will increase the perceived vulnerability to disease	This was rejected. Though the pilot study validated to priming effect, the larger sample size during the full experiment failed to show a difference between control and treatment
H1b	Visual stimuli of people with visible symptoms of illness will increase conspicuous consumption.	This was rejected. Due to H1a being rejected, there could not be a link between the primed treatment group and conspicuous consumption
H1c	Visual stimuli of people with visible symptoms of illness will alter levels of neophobia, in any direction.	This was rejected. Due to H1a being rejected, there could not be a link between the primed treatment group and neophobia
H2a	An increase in parasite stress level will result in an increase in conspicuous consumption.	This hypothesis was supported. Parasite stress levels were positively correlated with conspicuous consumption
H2b	An increase in parasite stress level will have an affect on levels of neophobia in any direction.	This hypothesis was supported. Parasite stress levels were positively correlated with neophobia. However, general neophobia showed a stronger correlation to parasite stress levels than food neophobia. This indicates that the resources (social interactions, food, etc.) may act as a moderator

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Appendix A

(Treatment visual cues)

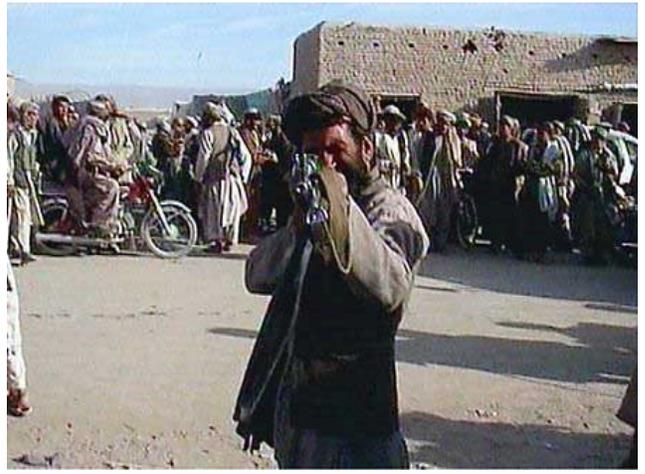
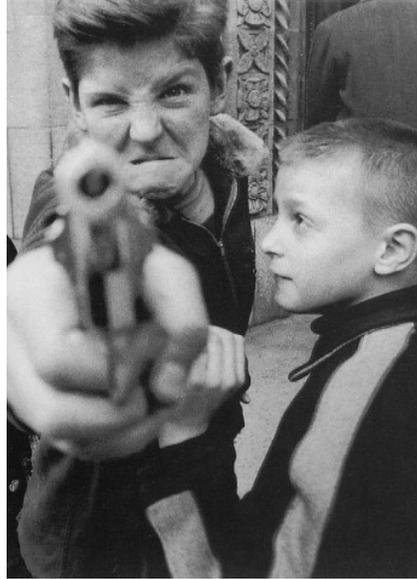


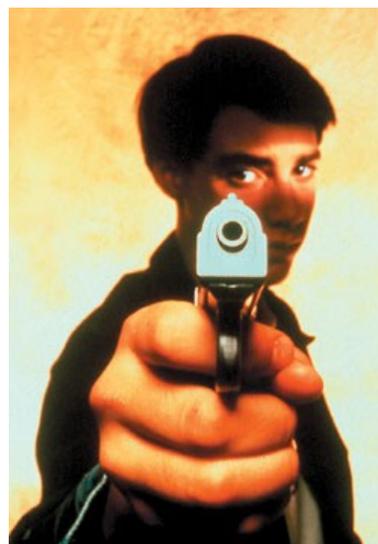




(Control visual cues)







Appendix B

i. Kruskal-Wallis Test: perceived vulnerability versus prime group

Control	Treatment
Visual cues, no context	Visual cues, no context
Visual cues with context question	Visual cues with context question
Visual cues with audio and context question	Visual cues with audio and context question

There was no significant difference among treatment and control types ($p = 0.097$, $p = 0.094$, $p = 0.372$ respectively).

The treatment and control group with the largest difference of medians was the visual cues with context question (Control Z-value = -1.61 vs Treatment Z-value = +2.33).

Test

Null hypothesis H_0 : All medians are equal
 Alternative hypothesis H_a : At least one median is different

<u>Method</u>	<u>DF</u>	<u>H-Value</u>	<u>P-Value</u>
Not adjusted for ties	5	9.31	0.097
Adjusted for ties	5	9.32	0.097

Descriptive Statistics

<u>Prime group</u>	<u>N</u>	<u>Median</u>	<u>Mean Rank</u>	<u>Z-Value</u>
Gun No Context	31	3.60000	72.7	-1.22
Gun W/ Context	23	3.66667	67.3	-1.61
Gun W/ Context + Audio	35	3.66667	77.7	-0.61
Sick No Context	22	3.80000	84.2	0.24
Sick W/ Context	23	4.13333	103.2	2.33
Sick W/ Context + Audio	29	4.06667	90.3	1.04
Overall	163		82.0	

ii. One-way ANOVA: perceived vulnerability versus prime group

There is no significant difference among treatments for germ aversion ($p = 0.073$) but, both perceived vulnerability and perceived infectability were significantly different between treatment and control ($p = 0.002$ Mean C:3.55 vs T:4.35, $p = 0.021$ Mean C:3.08 vs T:4.03)

One-way ANOVA for germ aversion versus cue with context question

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Prime group	1	5.307	5.307	3.37	0.073
Error	44	69.391	1.577		
Total	45	74.699			

One-way ANOVA for perceived vulnerability versus cue with context question

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Prime group	1	7.467	7.4671	10.31	0.002
Error	44	31.852	0.7239		
Total	45	39.319			

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
0.850833	18.99%	17.15%	11.46%

One-way ANOVA for perceived infectability versus cue with context question

Analysis of Variance

<u>Source</u>	<u>DF</u>	<u>Adj SS</u>	<u>Adj MS</u>	<u>F-Value</u>	<u>P-Value</u>
Prime group	1	10.39	10.386	5.69	0.021
Error	44	80.28	1.824		
Total	45	90.66			

Model Summary

<u>S</u>	<u>R-sq</u>	<u>R-sq(adj)</u>	<u>R-sq(pred)</u>
1.35073	11.46%	9.44%	3.22%

Appendix C

Scales used for the studies

General Neophobia Scale (GNS)

- 1) I feel uncomfortable when I find myself in novel situations.
- 2) Whenever I'm away, I want to get home to my familiar surroundings
- 3) I am afraid of the unknown.
- 4) I am very uncomfortable in new situations.
- 5) Whenever I am on vacation, I can't wait to get home.
- 6) I avoid speaking to people I do not know when I go to a party.
- 7) I feel uneasy in unfamiliar surroundings.
- 8) I don't like sitting next to someone I don't know.

Food Neophobia Scale (FNS)

- 1) I am constantly sampling new and different foods
- 2) I don't trust new foods.
- 3) If I don't know what is in a food, I won't try it.
- 4) I like foods from different countries.
- 5) Ethnic food looks too weird to eat.
- 6) At dinner parties, I will try a new food.
- 7) I am afraid to eat things I have never had before.
- 8) I am very particular about the foods I will eat.
- 9) I will eat almost anything.
- 10) I like to try new ethnic restaurants.

Source:

Pliner, P., and Hobden, K. (1992). Development of a scale to measure the trait of food neophobia in humans. *Appetite*, 19(2), 105-120.

VARSEEK Scale

- 1) When I eat out, I like to try the most unusual items, even if I am not sure I would like them.
- 2) While preparing foods or snacks, I like to try out new recipes.
- 3) I think it is fun to try out food items one is not familiar with.
- 4) I am eager to know what kind of foods people from other countries eat.
- 5) I like to eat exotic foods.
- 6) Items on the menu that I am unfamiliar with make me curious.
- 7) I prefer to eat food products I am used to.
- 8) I am curious about food products I am not familiar with.

Source:

Van Trijp, Hans CM, and Jan-Benedict EM Steenkamp (1992). Consumers' variety seeking tendency with respect to foods: Measurement and managerial implications. *European Review of Agricultural Economics*, 19 (2),:181-195.

The 11-item Conspicuous Consumption Orientation Scale

- 1) It says something to people around me when I buy a high-priced brand
- 2) I buy some products because I want to show others that I am wealthy
- 3) I would be a member in a businessmen's posh club
- 4) Given a chance, I would hang an expensive painting in drawing my room
- 5) I would buy an interesting and uncommon version of a product otherwise available with a plain design, to show others that I have an original taste
- 6) Others wish they could match my eyes for beauty and taste
- 7) By choosing a product having an exotic look and design, I show my friends that I am different
- 8) I choose products or brands to create my own style that everybody admires
- 9) I always buy top-of-the-line products
- 10) I often try to find a more interesting version of the run-of-the-mill products, because I want to show others that I enjoy being original
- 11) I show to others that I am sophisticated

Source:

Roy Chaudhuri, H., Mazumdar, S., and Ghoshal, A. (2011). Conspicuous consumption orientation: Conceptualisation, scale development and validation. *Journal of Consumer Behaviour*, 10(4), 216-224.

Perceived Vulnerability to Disease

- 1) In general, I am very susceptible to colds, flu and other infectious diseases.
- 2) I am unlikely to catch a cold, flu or other illness, even if it is 'going around'
- 3) If an illness is 'going around', I will get it
- 4) My immune system protects me from most illnesses that other people get
- 5) I am more likely than the people around me to catch an infectious disease
- 6) My past experiences make me believe I am not likely to get sick even when my friends are sick.
- 7) I have a history of susceptibility to infectious disease
- 8) I prefer to wash my hands pretty soon after shaking someone's hand
- 9) I avoid using public telephones because of the risk that I may catch something from the previous user

- 10) I do not like to write with a pencil someone else has obviously chewed on
- 11) I dislike wearing used clothes because you do not know what the last person who wore it was like
- 12) I am comfortable sharing a water bottle with a friend
- 13) It really bothers me when people sneeze without covering their mouths
- 14) It does not make me anxious to be around sick people
- 15) My hands do not feel dirty after touching money

Source:

Duncan, L., Schaller, M. Park, J. (2009). Perceived vulnerability to disease: Development and validation of a 15-item self-report instrument. *Personality and Individual Differences*, 47(6), 541–546.

Appendix D

Experimental Statistical Analysis

- i. T-Tests comparing the means of four variables, conspicuous consumption, general neophobia, food neophobia, and variety seeking behaviour for the treatment and control groups. The tests showed no significant difference of any of the four behaviours between the treatment and control group.

Two-sample T-Test: mean conspicuous consumption for treatment/control

Test

Null hypothesis $H_0: \mu_1 - \mu_2 = 0$

Alternative hypothesis $H_1: \mu_1 - \mu_2 \neq 0$

<u>T-Value</u>	<u>DF</u>	<u>P-Value</u>
0.03	117	0.976

Two-sample T-Test: mean general neophobia for treatment/control

Test

Null hypothesis $H_0: \mu_1 - \mu_2 = 0$

Alternative hypothesis $H_1: \mu_1 - \mu_2 \neq 0$

<u>T-Value</u>	<u>DF</u>	<u>P-Value</u>
1.17	522	0.243

Two-sample T-Test: mean food neophobia for treatment/control

Test

Null hypothesis $H_0: \mu_1 - \mu_2 = 0$

Alternative hypothesis $H_1: \mu_1 - \mu_2 \neq 0$

<u>T-Value</u>	<u>DF</u>	<u>P-Value</u>
0.62	519	0.537

Two-sample T-Test: mean variety seeking behaviour for treatment/control

Test

Null hypothesis $H_0: \mu_1 - \mu_2 = 0$

Alternative hypothesis $H_1: \mu_1 - \mu_2 \neq 0$

<u>T-Value</u>	<u>DF</u>	<u>P-Value</u>
-0.83	518	0.408

- ii. T-Tests comparing the difference of mean perceived vulnerability for the treatment and control group. The test showed that there was no significant difference in perceived vulnerability between the treatment and control group ($p = 0.573$)

Two-sample T-test: mean perceived vulnerability for treatment/control

Test

Null hypothesis $H_0: \mu_1 - \mu_2 = 0$

Alternative hypothesis $H_1: \mu_1 - \mu_2 \neq 0$

<u>T-Value</u>	<u>DF</u>	<u>P-Value</u>
0.56	522	0.573

- iii. Four simple regressions testing the relationship between perceived vulnerability and the four tested behaviours, conspicuous consumption, general neophobia, food neophobia, and variety seeking behaviour were conducted. These regressions demonstrated a significant positive relationship between perceived vulnerability and conspicuous consumption, general neophobia, and food neophobia via the simple regressions

Regression: Conspicuous Consumption versus Perceived Vulnerability

Coefficients

<u>Term</u>	<u>Coef</u>	<u>SE Coef</u>	<u>T-Value</u>	<u>P-Value</u>	<u>VIF</u>
Constant	2.305	0.510	4.52	0.000	
Perc vul	0.312	0.143	2.18	0.031	1.00

Regression Equation

Consp Cons = 2.305 + 0.312 Perc vul

Regression: General Neophobia versus Perceived Vulnerability

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	2.384	0.221	10.79	0.000	
Perc vul	0.4853	0.0612	7.93	0.000	1.00

Regression Equation

GNS score = 2.384 + 0.4853 Perc vul

Regression: Food Neophobia versus Perceived Vulnerability

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	1.942	0.223	8.70	0.000	
Perc vul	0.1952	0.0618	3.16	0.002	1.00

Regression Equation

FNS score = 1.942 + 0.1952 Perc vul

Regression: Variety Seeking versus Perceived Vulnerability

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	4.548	0.226	20.11	0.000	
Perc vul	-0.0025	0.0626	-0.04	0.968	1.00

Regression Equation

VAR Score = 4.548 - 0.0025 Perc vul

Appendix E

Cross-Cultural Statistical Analysis

- i. Stepwise regression for perceived vulnerability versus the four types of DALY scores.

Stepwise regression with forward selection and alpha of 0.15 showed that both types of parasite DALY's had a significant relationship to perceived vulnerability was the parasite ($p = 0.016$ current country parasite DALY and $p = 0.071$ birth country parasite DALY)

Forward Selection of Terms

Candidate terms: General DALY Current, Parasite DALY Current, General DALY birth, Parasite DALY birth

	-----Step 1-----		-----Step 2-----	
	Coef	P	Coef	P
Constant	3.6681		3.6821	
Parasite DALY Current	0.0237	0.113	0.0546	0.016
Parasite DALY birth			-0.0336	0.071
S		0.609156		0.606934
R-sq		0.81%		1.85%
R-sq(adj)		0.49%		1.21%
Mallows' Cp		4.29		3.01
AICc		580.18		578.95
BIC		591.34		593.79

a to enter = 0.15

- ii. Four simple regressions were completed to test the relationship between regression revealed that the infectious disease DALY per 100,000 and the four tested behaviours, conspicuous consumption, general neophobia, food neophobia, and variety seeking behaviour. These regressions demonstrated a significant positive relationship between perceived vulnerability and conspicuous consumption, general neophobia, and food neophobia as well as a negative positive relationship to variety seeking behaviour.

Regression: Conspicuous Consumption versus infectious disease DALY per 100,000

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	4.128	0.108	38.33	0.000	
Parasite	0.2573	0.0342	7.52	0.000	1.00

Regression Equation

Cons score = 4.128 + 0.2573 Parasite

Regression: General Neophobia versus infectious disease DALY per 100,000

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	4.5931	0.0979	46.90	0.000	
Parasite	0.1502	0.0311	4.83	0.000	1.00

Regression Equation

GNS Score = 4.5931 + 0.1502 Parasite

Regression: Food Neophobia versus infectious disease DALY per 100,000

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	2.9763	0.0663	44.90	0.000	
Parasite	0.0591	0.0211	2.81	0.005	1.00

Regression Equation

FNS Score = 2.9763 + 0.0591 Parasite

Regression: Variety Seeking versus infectious disease DALY per 100,000

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	1.8121	0.0708	25.59	0.000	
Parasite	-0.0881	0.0225	-3.92	0.000	1.00

Regression Equation

$$\text{VARS Score} = 1.8121 - 0.0881 \text{ Parasite}$$

- iii. Two simple regressions were completed to test that the relationship between dependent variables, perceived vulnerability as well as perceived infectability, and infectious disease DALY per 100,000. These two simple regressions showed that perceived vulnerability ($p = 0.116$) did not have a significant relationship to infectious disease DALY per 100,000 but, perceived infectability did ($p = 0.003$).

Regression: Perceived Vulnerability versus infectious disease DALY per 100,000

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	3.6681	0.0508	72.26	0.000	
Parasite DALY Current	0.0237	0.0149	1.59	0.113	1.00

Regression: Perceived Infectability versus infectious disease DALY per 100,000

Coefficients

<u>Term</u>	<u>Coef</u>	<u>SE Coef</u>	<u>T-Value</u>	<u>P-Value</u>	<u>VIF</u>
Constant	3.2196	0.0747	43.12	0.000	
Parasite DALY Current	0.0661	0.0219	3.02	0.003	1.00

Regression Equation

Per Inf = 3.2196 + 0.0661 Parasite DALY Current