WHY WE BUY WHAT OTHERS BUY

The role of product popularity in consumer decision making

Robert P. G. Goedegebure

Propositions

1. Popularity makes products radiate quality and approval.
   (this thesis)
2. Popularity's duality manifests itself on a biological and a psychological level. (this thesis)
3. Successful experimental research relies on a researcher's DIY-mentality.
4. The fast route to collect data implies a long route to understanding.
5. Small-scale initiatives offer effective solutions for large environmental problems.
6. Providing online product ratings is the modern-day equivalent of stamp collecting.

Propositions belonging to the thesis, entitled

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Wageningen, Wednesday 23 October 2019

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Thesis

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Chapter 1

General introduction

Social influence is an important determinant in consumer decision making. For consumers, following others may satisfy fundamental human motives such as protecting oneself from harm (Griskevicius, Goldstein, Mortensen, Cialdini, & Kenrick, 2006; Raafat, Chater, & Frith, 2009). From an evolutionary perspective, following others is considered an adaptive way of learning about the world and of making choices (Laland, 2004). Many of the daily choices that consumers make are driven by social influences. The effectiveness of social influence persists for both low- and high involvement products (Kuenzel & Musters, 2007; Salazar, Oerlemans, & van Stroe-Biezen, 2013), and spans across many choice and consumption situations (Higgs & Thomas, 2016; Robinson, Thomas, Aveyard, & Higgs, 2014). Social influence can thus be considered an integral part in daily decision making. Given the importance of social influence and the influential consequences in consumers' choices, it is important to have a full understanding of why consumers follow others. The purpose of this thesis is to investigate the psychological and neurological underpinnings of a special form of social influence that affects many daily choices: product popularity.

Product popularity is information about how many other consumers bought something. The decisions of consumers may be informed by information about popularity and what consumers infer about popularity (Deval, Mantel, Kardes, & Posavac, 2013). Consumers tend to use the information that is available to them to evaluate what to expect from a product and its performance (Kardes, 1988). That evaluation is then formed by self-generated inferences, which are "if-then" links between a piece of information and a conclusion (Kardes, Posavac, & Cronley, 2004). The generation of those links is often informed by lay theories and common-sense explanations (i.e., naive theories) that consumers hold to make sense of their daily lives (Deval et al., 2013; Furnham, 1988). The combination of those lay beliefs and inferences ultimately informs many of the daily decisions that consumers make.

Consumers are known to inform their choices with inferences that are drawn from many different sources of information (Kardes et al., 2004; Loersch & Payne, 2011). In a store environment, there are many different cues that provide consumers with information about a product's value (J. Baker, Parasuraman, Grewal, & Voss, 2002). The value that consumers ascribe to a product may reflect perceived functional product performance, the emotional utility that may be derived from consumption, the potential of the product to satisfy a desire for knowledge, or the social associations that are linked to consumption of the product (Sheth, Newman, & Gross, 1991). A particular product value that consumers may be interested in relates to the social identity that product ownership or consumption could signal. For example, consumers may want to buy expensive products because ownership of those products may signal status or being rich (Corneo & Jeanne, 1997). As such, consumers look at the attributes of a product to determine the social signals they can send out when choosing (or consuming) that product. Product popularity could also serve as information to infer the social identity that consumers can signal by owning the product.

Product popularity may also help consumers to draw inferences about the product's functional properties such as the product's performance. When many people buy a product, consumers may draw the inference that that product is likely to be of good quality. Consumers could be right in drawing that inference, because evidence hints towards a positive link between market share and relative product quality (Buzzel & Wiersema, 1981). The quality of a product may thus also be inferred through popularity, in addition to other cues such as product price (Miyazaki, Grewal, & Goodstein, 2005; Rao & Monroe, 1989). However, product quality may not be the only product-related inference that consumers draw from popularity and there may be more inferences to be uncovered (J. R. Parker & Lehmann, 2011). The product-related inferences that can be drawn based upon popularity have

received little attention to date. Yet, the prevalence of popularity information in daily settings makes it an important avenue for research.

There is an increase in the availability of information on which types of products consumers buy and how many consumers already bought a product. This latter information in particular is increasingly employed by retailers and made available to consumers (He & Oppewal, 2017). For example, Book Depository keeps its online shoppers updated about the books that other consumers buy, and retailers on eBay tend to indicate how many units of a product they have already sold. The information about popularity, often expressed through sales numbers, can be a strong determinant in consumer decision making (Babić Rosario, Sotgiu, De Valck, & Bijmolt, 2016).

In recent years, social influences are also increasingly used in the development of health-related intervention programs (Reid, Cialdini, & Aiken, 2010) and social marketing campaigns (Burchell, Rettie, & Patel, 2013). There are many campaigns that include information about the healthy choices that other consumers make. Examples include anti-smoking campaigns, or campaigns that are focussed on healthy consumption behaviour such as limiting alcohol intake. Thus, an increased understanding of product popularity may not only lead to fruitful managerial implications, but it may also provide further directions on how to employ information about what others do to improve consumer well-being.

Types of social influence

The information about the behaviour of other consumers comes in different forms from multiple sources. Consumers may look at single individuals, such as role models, to help them determine who or what they aspire to be. A role model may convey a social identity that has properties that consumers find desirable. Consumers may aspire to be similar to that person and that aspiration can facilitate choice (Dimofte, Goodstein, &

Brumbaugh, 2014). Role models such as celebrities are often persuasive in guiding choice because consumers consider it rewarding to follow those persons (Klucharev, Smidts, & Fernández, 2008). As such, consumers may choose to act similar to social others.

Many consumer choices are driven by the potential to signal a social identity (Escalas & Bettman, 2005; White & Dahl, 2007). In situations where consumers feel that they connect with that social identity, the behaviour that is signalled does not necessarily have to reflect the behaviour of a large group of consumers (Wood, Lundgren, Ouellette, Busceme, & Blackstone, 1994). Even small numbers of people, going as small as one or two, are known to exert social influence (Tanford & Penrod, 1984). The effects of these so-called minority groups appear most effective in situations where taste is important (Spears, Ellemers, & Doosje, 2009).

For larger groups, following others is often also considered rewarding (Falk & Scholz, 2018). The majority of research that examines the effects that large groups may exert on individual consumers emphasizes the role of social norms, and particularly descriptive norms. Descriptive norms provide a standard for what is considered typical or normal and offer evidence for what would be effective and adaptive behaviour (Cialdini, Reno, & Kallgren, 1990). Descriptive norms are a normative form of social influence and are often embedded within a particular social group. It is non-obligatory to follow descriptive norms, yet the choice to (not) do so is often equated with (dis-) approval from others (Cialdini & Trost, 1998). The norm often represents socially desirable behaviour and tends to signal how to behave in a socially or societally approved manner. That signal on how to behave is considered social proof. Social proof is defined as information about the behaviour and choices of others, based on which consumers assume that there is a good reason why others do something. Consequently, following large groups of consumers is then considered an appropriate and effective way to behave (Cialdini, 2006; Surowiecki, 2004). Thus, for large groups and the descriptive

norms they set, following others may be driven by a desire (fear) to gain (dis-) approval.

Social proof in the context of descriptive norms shares similarities with social proof in the context of product popularity, but there are differences as well. First, the popularity of the product may be equated with socially or societally approved consumption, similar as in the context of the descriptive norm. However, social proof in the context of popularity may also be linked more directly to the product and the product's performance. Product popularity signals the widespread availability of a product (Deval et al., 2013), and the adoption of the product by large groups of consumers (Jeong & Kwon, 2012; Y. Lee, Hosanagar, & Tan, 2015; Salganik & Watts, 2008), often represented by a high market share (Dean, 1999; Tucker & Zhang, 2011). The popular product may also be considered appealing to the masses (Berns & Moore, 2012), preferred by many (Deval et al., 2013; Steinhart, Kamins, Mazursky, & Noy, 2014), and is as such not necessarily bounded by a particular social group. In that sense, popularity can signal what to expect about the utility of a product, and what to expect from others in terms of approval when a consumer chooses the popular product (DeSarbo, Kim, Choi, & Spaulding, 2002). So, social proof in the context of product popularity may allow consumers to draw inferences about the social consequences of buying a product, as well as about the functionality of the product.

Product popularity and social proof

Consumers may view the popularity of a product as offering social proof. That social proof may be interpreted via two different routes. Consumers may draw the conclusion that the popular product is good because it signals social value. According to Cialdini (2006) consumers may look at social proof to determine what is correct. In this view "According to the principle of social proof, one way that individuals determine appropriate

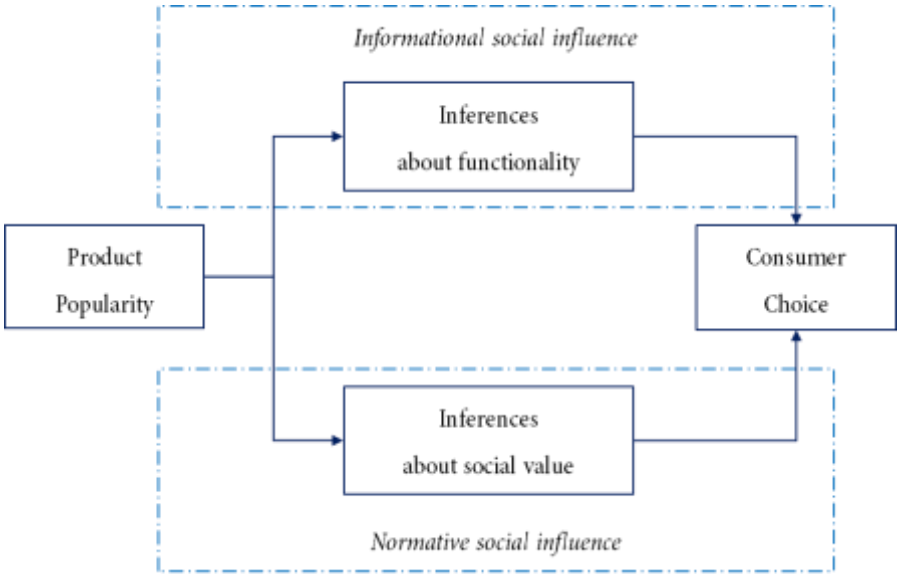
behaviour for themselves in a situation is to examine the behaviour of others there, especially similar others" (Cialdini, Wosinska, Barrett, Butner, & Gornik-Durose, p. 1243, 1999). The conclusion that the popular product must be appropriate is then informed by inferences of social value and the expectation that social approval is likely when the popular product is bought. Popularity then allows consumers to assess how they will be perceived would they be using or consuming the popular product by considering what others in their social circle approve of (Cialdini et al., 1990; Cialdini & Trost, 1998).

A second route follows a functional perspective that focusses on the product properties that are to be expected in terms of quality. In this case, social proof is defined as "the tendency to assume that if lots of people are doing something or believe something, there must be a good reason why. This is different from conformity because there is no assumption of peer pressure or a fear of being reprimanded" (Surowiecki, p. 43, 2004). This reasoning reflects that consumers assume that the behaviour of others reflects something about reality (Deutsch & Gerard, 1955). In this view, consumers may use popularity cues to make inferences about specific qualities of the product itself, purportedly because they assume that others have more information that they themselves do not have (Banerjee, 1992; Bikhchandani, Hirshleifer, & Welch, 1998). If consumers follow this line of thought, the conclusion that the popular product must be good is informed by inferences about the functional nature of the product.

The special nature of product popularity stems from the existence of the two potential routes through which product popularity may influence consumer decision making (see Figure 1.1 for a full overview of this process). The meaning that consumers ascribe to popularity may reflect both informational and normative concerns. This indicates that popularity may allow consumers to draw inferences about the social consequences of buying that product, as well as about a product and a product's functionality. We propose that both current perspectives, albeit relevant, provide only a partial

explanation of the effects of popularity on choice. In this thesis we extend existing insights on the effect of product popularity and propose complementary mechanisms for the two general routes through which popularity may exert its effect on choice.

Figure 1.1. Existing perspectives on product popularity and social influences



Social perspective on product popularity: social and societal

The social perspective on popularity is built on the assumption that consumers assume that the popular product outperforms other products in terms of social value. The perceived social value of a product allows consumers to assess the social consequences of consumption (Sheth et al., 1991). Social value thus encompasses inferences that reflect whether choosing or consuming a product enables consumers to enhance their own self-concept by obtaining approval, or making a good impression on others (Sweeney & Soutar, 2001). Consumers have a need to maintain a sense of belonging to a group, because of which they often try to act in line with a

particular social group (Brewer, 1991). Consumers model their behaviour to others as they feel it is approved of in their social circles (Cialdini & Goldstein, 2004). In this sense, mirroring the behaviour of others stems from a desire to maximize social outcomes (J. D. Campbell & Fairey, 1989) or to signal a particular social identity (Escalas & Bettman, 2005). Product popularity may thus be used to determine how to behave and to maintain a positive social identity with positive social relationships (Bagozzi & Lee, 2002; Kelman, 1961). As such, popularity is used to determine an effective, adaptive course of action that will lead to approval and avoid disapproval (Cialdini et al., 1990; Cialdini & Trost, 1998).

In some situations there is no (immediate or likely) approval from others to be expected based on one's behaviour. Consumers may still infer that choosing the popular product is considered the right choice. Yet, the decision to choose the popular product is likely not driven by inferences on social value. In those situations, consumers choose the product because of moral considerations. This means that consumers do not necessarily make a choice because they aim to signal a social identity, rather they make a choice because they consider it morally good choice. So, in addition to inferences about approval within a social circle, considerations on what is societally appropriate and considered right or wrong human conduct, expressed through general terms as "good", "bad", "virtuous" or "praiseworthy" (Reidenbach & Robin, 1990), matter as well. This general appropriateness may be inferred by examining popular behaviour (Cialdini & Trost, 1998; Gigerenzer, 2010). This moral value dimension encompasses the inferences made on how a particular choice or behaviour has an impact on a societal level.

Functional perspective on product popularity: quality and certainty

A second perspective on why consumers choose popular products is built on the assumption that consumers assume that the popular product

outperforms other products in terms of functional value. Inferences that revolve around the functional value of a product are related to the performance and quality of an option and reflect the utility that may be derived from choosing a product in terms of performance (Sweeney & Soutar, 2001). Consumers often believe that others hold information about product performance that they themselves do not have. In the situation that a majority of consumers has chosen a particular option, it may be assumed that all those consumers brought in particular product knowledge. Consequently, consumers assume that they will maximize the utility of their choices if they follow the choices of other consumers (Banerjee, 1992; Bikhchandani et al., 1998). The perceived utility (or quality) of a product then increases when the popularity of the product increases (Caminal & Vives, 1996). So, when consumers obtain knowledge about the widespread adoption of a product, it is assumed to be the popular and therefore qualitatively better choice (Deval et al., 2013; Steinhart et al., 2014). These effects may even hold when consumers know nothing about the product or its origin (Hansen, 2014).

Early studies have shown that consumers use the popular opinion to inform their product evaluations (Burnkrant & Cousineau, 1975; Venkatesan, 1966), which can lead to inferences about higher quality (Muchnik, Aral, & Taylor, 2013; Pincus & Waters, 1977). These inferences about quality can drive consumer choices (van Herpen, Pieters, & Zeelenberg, 2009). However, the choice for a popular product is not always explained by expectations of a higher performance. Parker and Lehmann (2011) were able to only partially link popularity to inferences of quality for several products. Although they did find popularity to drive product choice on several occasions, this was not fully mediated by inferences of quality. These results imply that there are other mediating constructs that are currently overlooked. These constructs may provide more insights into the product-related inferences that consumers may draw from popularity. The

insights that can be derived may further explain the effect that product popularity has on product choice.

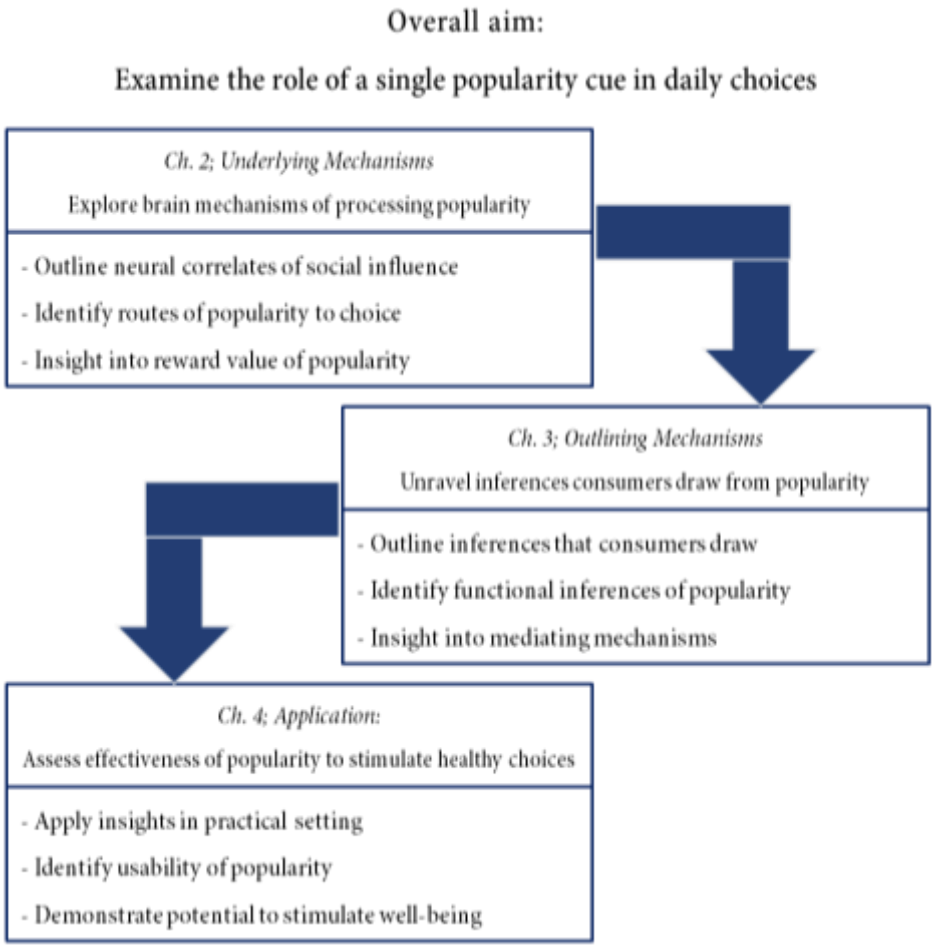
In this thesis we explore the concept of certainty about quality as an additional component to the functional value that consumers may derive from popularity. Popular products likely accommodate a broad range of consumers tastes, given the heterogeneity of consumer preferences (J. K. H. H. Lee, Sudhir, & Steckel, 2002). For example, some consumers may pay close attention to how salty a product is, whereas other consumers could focus on something completely different such as the country of origin. So, each consumer has his or her own unique preferences for the attributes of a product. Products that are popular send a signal that the product meets (or comes close to) the ideal preferences of the majority of consumers. In other words, each consumer in that majority is assumed to have his or her own reason for why the popular product outperforms other products in the choice set. The fact that a majority of consumers, with all those different preferences, have bought a product could then reflect a high *probability* that that choice is actually good (Bentley, O'Brien, & Brock, 2014; Surowiecki, 2004). This means that information about popularity may increase consumers' certainty that product quality is (at least) satisfactory. The product might not perfectly fit the preferences, but at the same time, it is unlikely to disappoint because it is able to satisfy many consumers (Tucker & Zhang, 2011). Thus, consumers may assume that others know something (more) about a product that they themselves do not know. This will likely lead to both inferences of quality and certainty about that quality.

Aims and outline of the thesis

The overall aim of this thesis is to examine how a single popularity cue affects consumers' choices for food products by exploring the neurological and psychological mechanisms. In the final part of the thesis, these insights are used to develop popularity cues that consumers may use in

their decision making. We test these cues in the domain of healthy choices and assess the potential of popularity cues to stimulate healthful consumer decision making. Please see Figure 1.2 for a graphical overview of the content of this thesis.

Figure 1.2. Graphical overview of this thesis



Chapter 2 explores two distinct neural routes through which popularity may influence consumer behaviour. We propose that there are two neural routes that reflect either informational social influences or

normative social influences. With the help of an fMRI experiment, the chapter explores which brain mechanisms are used to draw inferences from popularity cues, how these contribute to the assessment of choice value, and how the brain mechanisms are accountable for the effect of popularity.

Chapter 3 shows that on the informational route, one can distinguish between quality and certainty about quality. We propose that current perspectives on consumers' naive theories of popularity are incomplete. The chapter extends existing perspectives by offering a novel account of the inferential mechanism of certainty regarding product quality. Across five experiments, we examine the consistency with which consumers make this inference about certainty, outline its unique nature, and test if the concept of certainty aids in explaining socially influenced choices (i.e., mediates effects of popularity on choice).

Chapter 4 combines the insights of the previous chapters and examines practical implications of using popularity cues as a tool of persuasion. It builds upon the insight that a popularity cue may signal certainty about quality. We test how this insight could be applied in a choice setting relevant to daily consumer decision making. In a virtual reality experiment, the popularity cue is linked to different supermarket products, including those products that have a disadvantage as a result of their more healthful nature. Specifically, the chapter explores whether popularity cues can be used to stimulate the choice for products with a sensory disadvantage (e.g., less fat or salt) that are perceived as lesser in quality than regular alternatives.

Chapter 5 concludes this thesis by summarizing the findings, providing a general discussion, and outlining several avenues for future research.

Chapter 2

The subjective value of popularity: A neural account of how popularity influences behaviour using a social and quality focus

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Abstract

Research on social influences often distinguishes between social and quality incentives to ascribe meaning to the value that popularity conveys. Neurological knowledge on this distinction is rather limited. The current research examines the neural correlates of those routes through which popularity exerts its effect on consumer preferences and behaviour. This research reports the results of an fMRI experiment in which consumers evaluated a large set of food products from three perspectives, each with a specific focus; a normal focus, a focus on social aspects, and a focus on quality. We show that for consumers with a social (vs. normal) focus, popularity leads to activity in brain regions that compute social value which positively interacts with regions that compute general reward value. The combined activation positively mediates the effect of popularity on preference. For consumers who hold a quality (vs. normal) focus, popularity activates a quality network. This activity negatively affected consumers' preferences, which suggests an automatic link between popularity and quality. The neural pattern is reflected in the pattern of results from an additional behavioural task. Together, these results provide the first neurological evidence that a single popularity cue can in different ways, influence the value derived from product popularity.

Popular products are often considered popular for a particular reason. The notion that others found a product worthwhile and bought it is used to evaluate the popular product. Consumers then ascribe to the (popular) product a subjective value derived from the product's popularity. This value may be expressed either in terms of expectations on how to behave and on getting approval from social peers (Berger & Heath, 2007) or in terms of product functionality (Steinhart et al., 2014). These are the two routes through which popularity aids in value assessment. We refer to these as the social and quality routes, respectively. Researchers often distinguish between these two routes by noting either normative (i.e., social) incentives or informational (i.e., quality) incentives to be derived from choosing a popular option (Cialdini et al., 1990; Deutsch & Gerard, 1955). Thus, at a behavioural level, consumers may infer that the popular product has the highest value because it outperforms competing products in terms of social approval (i.e., "others buy it, so it must be the approved choice") and /or in terms of quality (i.e., "others buy it, so it must be good.")

The subjective value consumers perceive and ascribe to products is critical for their behaviour towards those products. This is emphasized by a wealth of economic and psychological theories (Kahneman & Tversky, 1979; Sheth et al., 1991) and validated by an increasing body of neuroscientific research on consumers' internal valuation system (Bartra, McGuire, & Kable, 2013; Levy & Glimcher, 2012). For behavioural acts influenced by the behaviour of others, activity in brain areas that compute value may play an important role (Falk & Scholz, 2018). For example, activity in these areas has been linked to explanations of how the preferences of others influence one's own preferences for abstract symbols (Mason, Dyer, & Norton, 2009), how group choices may determine (un)healthy food choices (Nook & Zaki, 2015), and to predicting actual popularity of songs (Berns & Moore, 2012). Nonetheless, it remains unclear whether the activity in the internal valuation system is the result of an integration of information for the purpose of

assessing a product's normative incentives (i.e., social approval), its informative incentives (i.e., quality), or both (Toelch & Dolan, 2015). It seems unlikely that in all the above-mentioned studies, the final value derived from popularity is the result of activation in the same regions of the brain. The moment consumers use popularity to assess a product's value based on an assessment of either social approval or quality, it is not likely that one single brain region explains the value assessment (Ariely & Berns, 2010). In the current paper, we explore the distinction between neural correlates of normative incentives and informational incentives. Specifically, by using a neuroimaging technique, namely functional magnetic resonance imaging (fMRI), we aim to distinguish between the different neural routes (i.e., social approval vs. quality) through which popularity may determine a product's value.

The main goal of the current study is to examine the two routes (i.e., normative and informational) of social influence (Deutsch & Gerard, 1955) at a psychological and (converging) neurological level. Methodologically, we extend current neuroscientific research on social influence by presenting product popularity as input in the decision-making process rather than as feedback after the decision. Previous studies on social (normative) influences typically investigate neural activation by providing social feedback after participants have provided responses and then measuring the difference in activation (Falk & Scholz, 2018). In contrast, our current study follows a social input approach. Participants are given information on popularity at the moment of evaluation to track how popularity guides the value computation and influences behaviour. In doing so, we draw upon insights that show how consumers use a single piece of information for multiple purposes (Hare, Malmaud, & Rangel, 2011). This allows us to more clearly distinguish between normative and informational social influence. By using novel insights from neuroimaging, these routes can be studied in an unbiased way, providing a richer understanding of the process of popularity and

complementing the use of traditional self-reported scales (Morales, Amir, & Lee, 2017; Plassmann, Venkatraman, Huettel, & Yoon, 2015). In the current study, we aim to (1) outline the neural correlates for normative social influences and for informational social influences, (2) assess the extent to which the correlates of these routes may deviate (or overlap), and (3) examine whether the neural routes reflect self-reported inferences of social approval and quality.

The remainder of this study is structured as follows. In the next section, we review literature on popularity and consumer behaviour from both the marketing and neuroscientific literature. The aim of the section is to determine different neural routes through which popularity could aid in the assessment of either a social product value or a functional product value. We present the results of a behavioural task and an fMRI study to uncover these two routes. We conclude the study by discussing our findings and their limitations and several directions for future research.

Popularity and social approval

The normative route of social influence is equated with behaving in accordance with the positive expectations and potential approval of others (Cialdini & Trost, 1998; Deutsch & Gerard, 1955). Consumers may thus look at others to decide which product they should choose so as to make a good impression on others and to connect with their social peers so as to gain approval and avoid disapproval. The desire to connect with others and avoid disapproval can have a strong influence on consumer behaviour as evidenced by the classic study of Asch (1956). In his study, Asch demonstrated that despite obvious evidence, participants still go along with the group even though they know it is not the best choice to make. Especially in situations where consumers share a close connection with others they tend to follow popular behaviour (Berger & Heath, 2008). In general, consumers want to express themselves and signal who they are and with whom they connect

(Escalas & Bettman, 2005). Product popularity may then be a great source of information to determine potential social (dis)approval and to assess a product's social value.

The concept of social value encompasses different elements related to expectations of others' approval, such as the perception of the extent to which a product signals an identity or would impress social peers, and whether the choice is deemed appropriate (Sweeney & Soutar, 2001). Neurologically, such social valuation has been equated with activity in the middle medial prefrontal cortex (MMPFC), the dorsal medial prefrontal cortex (DMPFC), precuneus (PC), bilateral temporal junction (TPJ), and in the right superior temporal sulcus (rSTS) (Baek, Scholz, O'Donnell, & Falk, 2017). In particular, activity in the TPJ and STS has been found to reflect thinking about the behaviour and opinions of others (Abu-Akel & Shamay-Tsoory, 2011; Schurz, Radua, Aichhorn, Richlan, & Perner, 2014; Van Overwalle, 2009). Social evaluation is also concerned with expectations of (how to avoid) social penalties, which suggests that the anterior insula (AI) and anterior cingulate cortex (ACC) are also involved because these reflect the decision to conform to opinions of others while considering social penalties (Berns, Capra, Moore, & Noussair, 2010; Cascio, Scholz, & Falk, 2015; Eisenberger, 2012). Together, all these named regions of the brain are likely to represent a neural collective that is involved with consumer choices that take into account possible social (dis)approval.

We propose that product popularity evokes inferences of social value. As such, we expect that consumers who examine a product to assess social approval resulting from a product choice will draw from existing knowledge on what others may think to assess the social consequences of their own choice. In doing so, activation in a neural collective that is equated with thinking about the behaviour and opinions of others will influence the preferences that consumers form. Popularity will affect the influence on consumers' preferences and will increase the positive valence of the

activation. Furthermore, we propose that the inferences of social value mediate the relationship between popularity and preference and therefore expect that the activation in the proposed brain regions plays a mediating role as well. Formally, we hypothesize that:

$H1_A$: Product popularity increases neural activity in the PC, MMPFC, DMPFC, rSTS, AI, TPJ, and the ACC (i.e., neural social approval collective).
$H1_B$: Activity in the neural social approval collective mediates the effect of popularity on behaviour.

Popularity and quality

In their seminal paper on the two forms of social influence, Deutsch and Gerard (1955) define informational social influence as the tendency of consumers to view information about others' behaviour as evidence for reality. This means that when consumers see many others behave in a certain way by choosing the same option, consumers assume that option to be the best one in the choice set. Indeed, consumers tend to choose what others have chosen because they believe that this gives the best chance of them ending up with the best option as well (Bikhchandani et al., 1998). As evidenced by the literature, this link between product popularity and product quality has been studied extensively and in various ways. For example, Cohen and Golden (1972) demonstrated that coffee is perceived to taste better when one knows others enjoyed it as well. Tucker and Zhang (2011) found that consumers perceive popular wedding dresses to come from the better vendors. Steinhart and colleagues (2014) demonstrated that popular products are often equated with a higher degree of functionality. These studies suggest that consumers assume that when others buy a product that that product is a functional, well-made, and qualitatively better product than other products in the choice set.

The information consumers draw from popularity on the informational social influence route all relate to elements of perceived

functional value. Functional value reflects a product's quality and encompasses elements such as product workmanship, consistency of quality, and quality reliability (Sweeney & Soutar, 2001). One way to arrive at such an evaluation of quality is to evaluate the product on attributes one deems critical for proper functioning. For example, if one is considering buying a chair, one will likely want to know how it sits. Similarly, if one is contemplating buying a box of cookies, one will likely think about how those cookies will taste. In order to form those expectations, consumers need to rely on the knowledge they have about that particular product option.

In neurological terms, knowledge about objects (i.e., products) is stored in the lateral and ventral regions of the temporal cortex (Chao, Haxby, & Martin, 1999). These regions serve as a personal library that stores information about the objects that consumers know and the elements they find critically relevant for the performance of an object. For that object to be deemed "better in performance," consumers will look for positive features in the product. In consumer settings, the temporal cortex also aids consumers to assess the functional value of products by considering the different product attributes (Couwenberg et al. 2017). The integration of this information about the attributes is often reflected in activity in the (medial) orbitofrontal cortex and the medial prefrontal cortex (mPFC) (Karmarkar & Yoon, 2016; Knutson, Rick, Wimmer, Prelec, & Loewenstein, 2007; Plassmann, O'Doherty, Shiv, & Rangel, 2008; Rushworth & Behrens, 2008). In particular, the medial OFC (mOFC) is known to be active when it comes to assessing and integrating information on the functionality of a choice for calculating a subjective reward value (Hare, O'Doherty, Camerer, Schultz, & Rangel, 2008; Kringelbach, 2005). Moreover, the mOFC has been specifically implicated as part of the assessment of product quality (Rangel, Camerer, & Montague, 2008). Thus, consumers who use popularity to assess product quality are likely to display activity in a collective of brain regions that is

comprised of a combination of the temporal cortex (ventral and lateral regions), the mOFC, and the mPFC.

Product popularity is proposed to evoke inferences of quality. We expect that consumers who examine a product to assess product quality will draw on existing knowledge about the specific properties of a product to derive at an outcome value. In doing so, what informs the consumers' preferences is the activation in a group of brain regions that is equated with functional benefits and the integration of information on marketplace offerings. Popularity will affect the informing of consumers' preferences by increasing the positive valence of the activation. Furthermore, we propose that the inferences of quality mediate the relationship between popularity and preference and thus expect that the activation in the proposed neural regions plays a mediating role as well. Formally, we hypothesize:

$H2_A$: Product popularity increases activity in the temporal cortex, the mOFC, and the mPFC (i.e., neural quality collective).
$H2_B$: Activity in the neural quality collective mediates the effect of popularity on behaviour.

Reward value of popularity

The popular option may be considered the better choice in terms of quality and/or social approval. Regardless of the type of inference consumers draw from the product's popularity, the final result will likely be an assessment of the product's total subjective (i.e., reward) value. Prior studies have produced neurological evidence that implicates specific regions in the brain to make up a consumers' valuation system (Bartra et al., 2013; Levy & Glimcher, 2012). This system consists of parts of the striatum (both left and right), the ventromedial prefrontal cortex (vmPFC), portions of the ACC and PCC, and parts of the anterior insula (both left and right). Activities in these regions have been linked to expecting and receiving different types of reward.

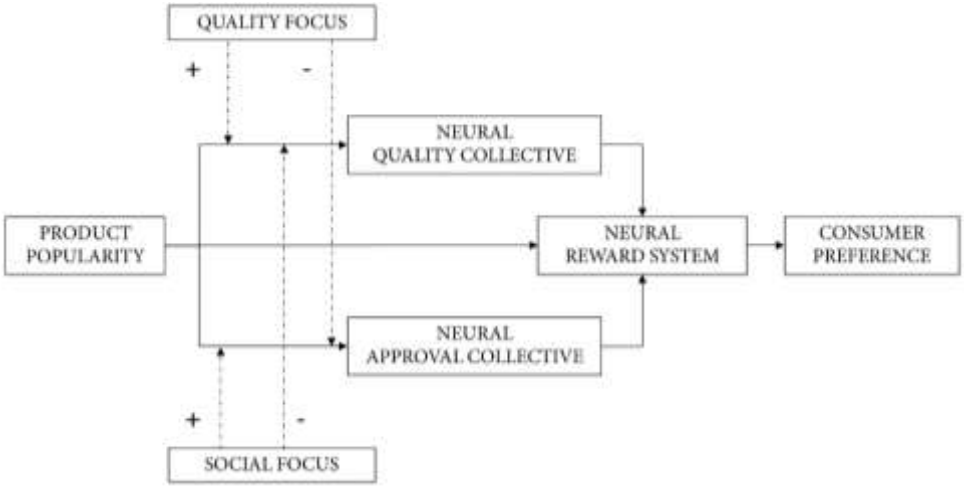
For example, the vmPFC has been found to encode the value for money, snacks, and different trinkets such as memorabilia (Chib, Rangel, Shimojo, & O'Doherty, 2009). More importantly, activity in regions of the valuation system has also been linked with socially influenced behaviour (Bhanji & Delgado, 2014). People who learn that others agree with their evaluations tend to display greater activity in portions of the striatum (Klucharev, Hytönen, Rijpkema, Smidts, & Fernández, 2009; Zaki, Schirmer, & Mitchell, 2011). Thus, the popular option may evoke activity in the valuation system. Nevertheless, we expect that this activity will be accompanied by activity in the neural quality collective and/or the neural social approval collective, depending on the inferences consumers draw from popularity to inform their decisions.

The inferences that inform consumers' decisions may be situationally specific when they make a decision in particular situations with a mindset focused on a certain outcome. Consumers' preferences and choices are influenced by the mindset they hold because the mindset determines how available information is used (Wyer Jr., 2008; Xu & Wyer Jr., 2007). Subsequent behaviour is then informed by the consumer's focus on the information in their environment at that moment (Kahneman & Miller, 1986; Loersch & Payne, 2011). In the case of product popularity, this means that consumers who are focused on social value will more likely activate the use of the normative aspects of popularity to infer social approval, whereas a focus on product quality will more likely use the informational aspects of popularity to infer quality. On a neurological level, we expect that this is reflected by distinctive activation in the neural quality collective and the neural social approval collective. On a behavioural level, the routes have been proposed to share properties (Cialdini & Goldstein, 2004). Yet, we propose that the two brain collectives, that reflect the quality and social routes, each have a distinctive contribution to the value computation.

For the subjective value of popularity, this means that when consumers focus on the social aspects of the situation, the combination of encoding value in both the social and reward systems is expected to occur; whereas the combination of encoding value in both the quality and reward systems is expected to occur when consumers focus on quality. In psychological terms, we propose that for consumers with a social focus, the effect of popularity on preference is mediated by inferences of social value, whereas for consumers with a quality focus, the effect of popularity on preference is mediated by inferences of quality. We expect that this pattern holds on a neurological level. Formally, we hypothesize the following (please see Figure 2.1 for a full overview of the conceptual framework):

H3: For consumers with a social focus, the route from popularity to behaviour is expressed through heightened activity in both the social approval neural collective and the reward system; whereas for consumers with a quality focus, the route from popularity to behaviour is expressed through heightened activity in both the neural quality collective and the reward system.

Figure 2.1. Conceptual Framework



Study: Neural correlates of product popularity

In the current study we examine the brain activation of consumers when they evaluate popular (versus unpopular) products in different focus conditions. In preparation for the main experiment several pre-tests were carried out to determine a target group with which participants could identify, and a method to easily convey product popularity in the MRI scanner to facilitate recognition of popularity.

Pre-test: Selection Target Group Description

In order to create the right description for a target group with which the participants could identify, we asked a group of female participants (n = 113) to evaluate one of three different vignettes that described a group of consumers. Vignette 1 contained a simple description of characteristics. Vignette 2 contained a narrative of a group of consumers, and the same for vignette 3.

Vignette 1.

These are characteristics of a subject pool for a large study spanning different local universities.

- Female
- Native
- 18–35 years of age
- Student
- BMI: 18.5–25 kg/m2
- Right-handed
- Cooking for themselves (and others)
- Doing their own groceries (and for others)
- Regular users of supermarket products
- A varied dietary pattern
- Critical and selective consumer

Vignette 2.

"This research is part of a larger study that is conducted at several local universities. In this study we are interested in how consumers evaluate new products. The participants in this study are local female students. These students do their own groceries. Their grocery list is often diverse and includes products such as dairy drinks, breakfast cereals, vegetables, fruits,

salty snacks, sweet snacks, and other types of snacks. Our participants are generally critical consumers, not only towards themselves, but also to others. They value variety and therefore buy a wide range of different types of products in the supermarket. Our participants clearly know what they want."

Vignette 3.

"This research is part of a larger study that is conducted by this university. In this study we are interested in how consumers evaluate new, unknown products. Participants in this study are local female students. These students do their own groceries. They cook for themselves and also for others, such as roommates or friends. Their grocery list is often diverse and includes products such as vegetables and fruit, as well as cottage cheese and granola bars. Our participants clearly know what they want. Not just for themselves but also for others. We often see this reflected in their preferences for particular types of products. The participants in general often agree about what they do and do not prefer."

Measures. First, participants evaluated the vignettes and rated them on belongingness and association (Escalas & Bettman, 2005) with 3 items for belongingness (e.g., "I consider myself to be this type of person") and 3 items for association (e.g., "I would like to be identified with this group and what they represent"), and 3 items for potential of influence on consumption-related preferences adapted from Viswanathan and colleagues (2000) (e.g., "The preferences within this group influence my choice for a type of store"). All items were phrased in the form of statements to which participants were asked to express their agreement (7-point scales, 1: completely disagree; 7: completely agree) and reliabilities were satisfactory (αs > .83). Next, participants were asked to indicate which characteristics of the group they liked the most and which they liked the least.

Results. The results of several Oneway ANOVAs showed that belongingness differed per vignette ($F(2, 112) = 3.07$, $p = .05$). Participants

indicated that they felt the most belongingness for the first vignette (M = 5.82, SD = 1.22). This was significantly higher than their belongingness scores for vignette 3 (M = 5.20, SD = 1.17, p = .016) but not higher than their belongingness scores for vignette 2 (M = 5.43, SD = .91, p = .128). Participants' association with the group in the vignette also differed per vignette (F(2, 112) = 5.36, p = .014). Participants associated most with the group from vignette 1 (M = 5.26, SD = 1.16). Association with the group described in this vignette was significantly higher than with the group in vignette 2 (M = 4.53. SD = 1.12, p = .005) and higher than with the group in vignette 3 (M = 4.74, SD = 1.03, p = .040). Participants did not feel that the groups would differently influence their consumption-related preferences (F(2, 112) = .62, p = .541).

The results of the open-ended questions showed that participants found the independence (in cooking and doing groceries) of the people in vignette 1 most favourable. They also liked that the group had a varied dietary pattern and was critical/selective. These latter favourable remarks were also applied to the group in vignette 2. The participants did not like the statements regarding being critical towards others. This also applied to vignette 3: participants favoured the independence and the varied dietary pattern but participants disliked the statement about knowing what they want not only for themselves but also for others. Participants did favour the ideas of being caring and social towards others.

Based upon these results we took the characteristics from vignette 1 and added the favoured characteristics from vignettes 2 and 3 regarding being caring and social. The final target group was presented as follows:

Target group description as presented to participants. "This research is part of a larger study that is conducted in several local universities. In this study we are interested in how consumers evaluate new products. The aim of this study is to gain more insights into the dietary patterns of

consumers, which may include choices for new products. In previous experiments we asked participants to evaluate new products. All participants are female students. You can recognize them by the following characteristics:"

Demographical	Lifestyle
- Female	- Regular user supermarket products
- Native	- Cooking for themselves (and others)
- Age 18–35	- Doing their own groceries
- Student	- Varied dietary pattern
- BMI: 20–25 kg/m2	- Critical and selective (clear opinion)
	- Caring and social

Pre-test: Selection Popularity Cue

In order to select an appropriate symbol to convey popularity, we asked a group of female participants (n = 50) to evaluate two types of popularity cues: a shopping basket with a percentage representing popularity or a shopping cart with a percentage representing popularity. Participants were told that they would participate in a study that involved evaluating salty snacks that were previously evaluated by other participants. The salty snacks in this study were labelled with a popularity score based on the previous study. Popularity was said to be expressed by a percentage, which is considered an effective method to convey popularity (Goldstein, Cialdini, & Griskevicius, 2008). The products in the current survey were either low in popularity (25%–35%) or high in popularity (65%–75%). Participants were told that the percentage was displayed with either a shopping basket (condition 1) or a shopping cart (condition 2). Participants were randomly allocated to one of these two conditions. The evaluation was a cover story; we were only interested in participants' understanding of the popularity cue.

In each of the conditions, participants evaluated four different salty snacks. Two of the products were low in popularity (25% and 35%) and two were high in popularity (65% and 75 %). As part of the cover, participants

evaluated each of the snacks on purchase intention ("I would like to buy this product"), quality ("This product is of a high quality"), and social identity ("This product is good for signalling a social identity"). Next, participants were asked what the symbol conveyed (open-ended question). Finally, participants were asked whether the symbol was a clear symbol for conveying popularity ("This is a clear symbol to convey popularity"), whether it was credible ("The symbol is a credible symbol to convey popularity"), and whether the symbol helped during the survey ("The symbol helped me to respond to the statements"). Participants were asked to express their agreement to all statements (9-point scales, 1: completely disagree; 7: completely agree).

Results. The participants in the condition with the shopping basket all correctly remembered (correct = 1, incorrect = 2) that the shopping basket conveyed popularity (100%). In the condition with the shopping cart, the number of participants that correctly remembered that the symbol conveyed popularity was lower (76%). This difference was significant ($\chi^2(1) = 6.82$, $p = .009$). Participants did not find the shopping cart clearer than the shopping basket ($F(1, 49) = .01$, $p = .949$), nor did they evaluate differently its credibility ($F(1, 49) = .02$, $p = .890$), or whether the symbol helped them ($F(1, 49) = .54$, $p = .464$). See table 2.1 for results. Based upon these results we decided to use a shopping basket containing a percentage to convey popularity.

Table 2.1.

Mean Scores and Standard Deviation

	Shopping basket	*Shopping cart*
Clarity	5.64 (1.89)	5.60 (2.48)
Credibility	4.76 (1.88)	4.84 (2.19)
Helpful	3.24 (1.67)	3.64 (2.14)
Remembered correctly	100%	76%

Main Experiment - Method

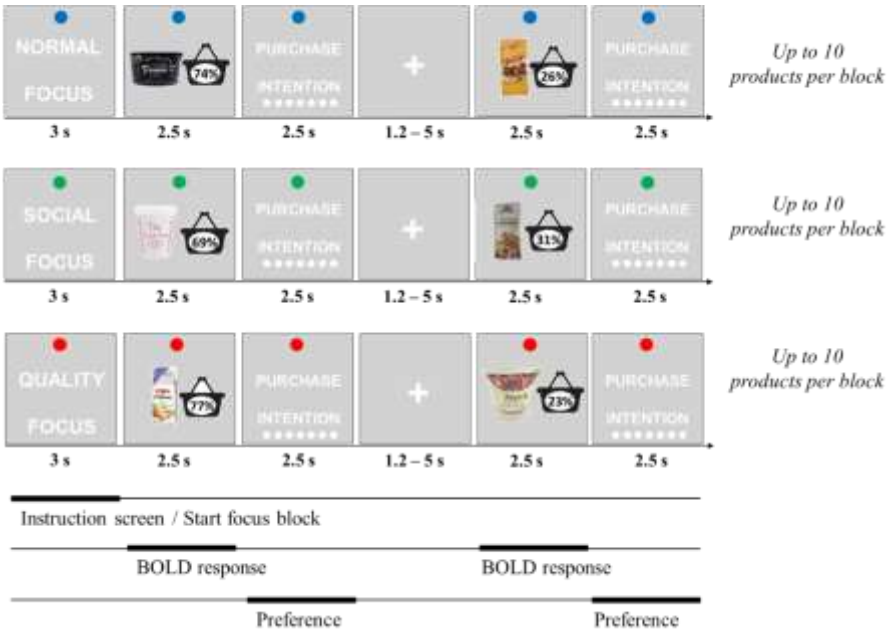
Participants. Thirty-three participants took part in the study. Two participants were excluded due to a programming error that interfered with the presentation of the stimuli. One participant was excluded because she had a panic attack during the data collection. We present data from 30 young (M_{age} = 22.2), right-handed female participants. To avoid potential interferences with the collection of brain images, participants were screened on several aspects. First, none of the participants reported a history of drug abuse, head trauma, neurological, or psychiatric illness. Second, they were screened to ensure that they were not currently following any specific diet or seeking to lose weight for any reason, or taking medications that could interfere with the performance of fMRI.

Participants were told during the first information meeting that they would be part of a large pool of participants who evaluated products in earlier versions of the current study. Unbeknownst to the participants, this was a fictitious subject pool and part of our manipulations (including the manipulation of popularity). The demographics of the subject pool were: female, native speakers, age 18–35 years old, student, healthy BMI; their lifestyle-related characteristics were: regular supermarket visits, doing your own cooking and grocery shopping, variation in dietary habits, strong opinion, and caring and social. A critical pre-requirement for inclusion in the current study was for a participant to have a strong association with the social group that comprised the fictitious subject pool. This was to increase the effectiveness of our popularity manipulation. Group association was measured with three (1–9 point scale) statements (adapted Escalas and Bettman (2005)) during the information meeting. Mean scores (> 7) were used as decision criteria to invite participants for further participation.

Design. The experiment followed a 3 (focus) X 2 (popularity) within-subjects design (see Figure 2.2 for an illustration). Participants were asked to express their purchase intention for 180 food products, divided over three

different focus conditions (Hare et al., 2011). The task was incentive-based. Participants were told that at the end of the study they would get one of the products that rated high in their purchase intention scores. To manipulate the focus condition and induce situation-specific mindsets, we asked participants to read different scenarios that represented the focus conditions (see Appendix A for full details). In the *normal focus* condition, the participants were asked to evaluate the products in the way they would usually do. In the *social focus* condition, the participants were asked to focus on the potential social value of the products and whether or not purchasing them would help to impress others and gain approval from social peers. In the *quality focus* condition, the participants were asked to focus on the products' quality-related properties and to assess whether or not the products were of high quality. Participants were instructed and informed about the conditions in a training session and the scan session to ensure that the task was clear.

Figure 2.2. Overview experimental design



The products presented in each condition where either low or high in popularity. Product popularity was manipulated by presenting to the participants the "popular choice scores" of the products, which were derived from previous studies. For each product, participants were shown a shopping basket symbol reflecting the percentage of previous participants who wanted to buy that product. These previous participants were said to have come from the same subject pool as the current participants. Low percentages represented low popularity, high percentages represented high popularity. To increase the credibility of the stimuli and to avoid repetition of the same percentage, percentages differed within a range (low: 23%–34%; high: 66%–77%). Percentages were embedded in the product visual, but combinations of product and popularity (low vs. high) were counterbalanced.

Participants evaluated a total of 180 products that were equally distributed across the six conditions. Participants were told that at the end of the study they would get one of the products they evaluated positively. To avoid order and timing effects that could interfere with brain activity, participants evaluated the products in 18 blocks of 10 products (5 high in popularity, 5 low in popularity) within a particular focus. Each of these focus blocks was introduced with an instruction screen (3s) to announce the focus of that condition. For example, participants first evaluated 10 products with a quality focus, and next they evaluated 10 products with a normal focus. The order in which these blocks were presented was randomized and counterbalanced across participants. The order of product presentation was fully randomized. Thus, each participant evaluated a set of 180 products in a unique order.

Stimuli. One hundred eighty digital photos of supermarket products were collected for the study. We collected the stimuli from an online database and selected them based on the criteria "introduction in the market from 2011–2015" and commercial unavailability in the Dutch market at the time of data collection. Products were selected from the categories: cookies,

desserts, sodas, and cheeses. These product categories were chosen because they could be part of regular grocery shopping and participants likely had experience with these types of products.

Procedure. Each participant took part in two sessions on two separate days, with 2–14 days in between. The first session entailed a training session at the university campus. The second session involved the scan session at the hospital where the university's scanner is located.

In the first session, the participants completed the following scales: trait conformity (Mehrabian & Stefl, 1995), susceptibility to interpersonal influence (Bearden, Netemeyer, & Teel, 1989), need to belong (Baumeister & Leary, 1995), association with the subject pool (Escalas & Bettman, 2005), and consumer need for uniqueness (Ruvio, Shoham, & Makovec Brenčič, 2008; Tian, Bearden, & Hunter, 2001). These measures were not used in the present study but were part of a different study design that tested the effects of these personality traits on the processing of social information.

Next, the participants practiced the scan task in a mock MRI scanner to get them accustomed to participating in an fMRI experiment. The stimuli used in this first session were different from those used in the main study. As the first session was purely instructional for the main study, we did not collect any imaging data during this session. No participants dropped out after this session.

During the main scan session, the participants evaluated 180 products in consecutive trials in an MRI scanner. Each trial started with the presentation of a picture of a product for 2.5 seconds. Next, participants were asked to indicate their purchase intention using a 7-point scale (1–7; starting point randomized) via a button box (2.5s). The participants were then shown a fixation cross of jittered length (1.2–4.8s). This completed the product trial. After completing 180 product trials, the participants continued with a different task (unrelated to the current study) in the scanner.

To validate the results obtained in the scanner, we asked the participants to complete an adapted version of the scan task after they had left the scanner. In this task, they expressed their purchase intention ("I would like to try this product") for a subset of the products from the scan task and evaluated those products in terms of social approval ("This product will make a good impression on others;" (Sweeney & Soutar, 2001), quality ("This product has a good quality;" (Sweeney & Soutar, 2001), and popularity ("This product is popular," to serve as a manipulation check). Measurements were in the form of statements to which participants had to indicate their agreement on 9-point scales (disagree–agree). This provided the additional behavioural measures to link inferences of social value and quality to neural correlates. We opted for a shortened version of the scan task because the full version would have been too strenuous for the participants. In each of the 18 blocks, the 2nd and 4th popular products and the 2nd and 4th unpopular ones were selected from a participants' product set. This comprised a total of 72 evaluations. Participants completed the task at their own pace (i.e., no time restraints) using a computer on which the products were presented visually identical to how they were presented in the scanner. At the end of this task, the participants completed the Consumers' Need For Uniqueness scale (Tian et al., 2001) and the Consumer Susceptibility to Interpersonal Influence scale (Bearden et al., 1989). These questionnaires were also administered during the practice session, but they were adapted to fit the choice for supermarket products.

MRI Data Acquisition. Functional data were collected in two consecutive MRI sessions. There was a small pause between sessions to give participants a moment of rest. The length of the sessions varied slightly and contained on average 354 volumes (758 seconds). The functional images were acquired using a T2-weighted gradient echo-planar imaging sequence (TR = 2140ms, TE = 25ms, 90° flip order, FOV = 192*192mm, descending order, 43 axial slices, voxel size = 3*3*3mm) on a 3T Siemens Magnetom Verio

(Siemens, Erlangen, Germany). We collected for each participant an additional anatomical scan (T1-weighted) (MPRAGE, TR = 2300ms, TE = 2.98ms, 9° flip angle, FOV = 256*256, 192 sagittal slices, voxel size = 1*1*1mm) after the collection of the functional scans.

MRI Data Analysis

Data Processing. To prepare the data for analysis, the brain images were pre-processed with SPM12 (Wellcome Department of Imaging Neuroscience, London, UK). Functional images of every participant were slice-time corrected to correct for time differences between respondents. Next, the images were realigned to the first volume of the first run to account for movement in the scanner. To allow for comparison between functional scans and the participants' anatomy within and beyond the sample, the functional and anatomical images were coregistered and globally normalized to the Montreal Neurological Institute space (MNI-space). To remove small anatomical differences, the images were spatially smoothed with a Gaussian kernel of 6mm full-width at half maximum. Next, to link timing of the events with the participants' biological reaction, a statistical parametric map was generated for every subject by fitting a boxcar function to each time series, convolved with the canonical hemodynamic response function. Data was high-pass filtered (cut-off: 128s) to remove low-frequency noise that could lead to false positives.

Subject-level analysis. The next preparatory step for analysis included, per participant, a specification of the design and the parts of each trial. Six conditions were modelled (c.f., 3 focus X 2 popularity study design) for the moments of product evaluation (i.e., stimulus presentation): normal focus + popular products; normal focus + unpopular products; social focus + popular products; social focus + unpopular products; quality focus + popular products; and quality focus + unpopular products. Participants also saw visuals such as the instruction screen (3s) and the response screen for

purchase intention (2.5s). We were not interested in the activity during these moments, so these moments were modelled as regressors of no interest. Finally, realignment parameters were added to account for variance that resulted from head movements in the scanner.

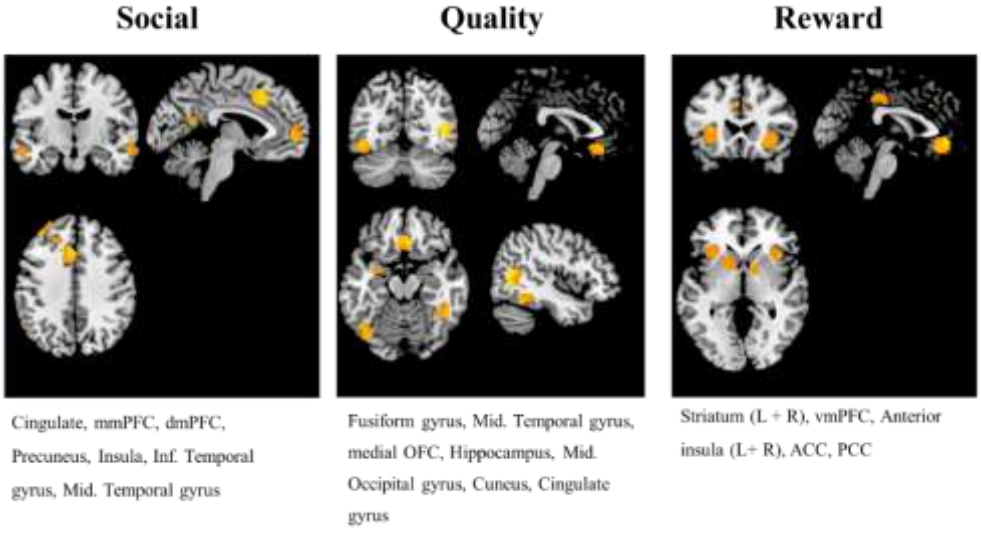
We estimated two models. The first model (i.e., model 1) was estimated exactly as described above. In the second model (i.e., model 2), purchase intention was included as a parametric modulator of the moments of evaluation. This second model examined the brain activity at the moment of evaluation that was correlated with the purchase intention in the six different study conditions. One participant was dropped from the data for this model because of a lack of variance in responding in one of the conditions, leaving a sample of 29 participants for model 2.

Regions of interest. To test our hypotheses, we created different masks that contained a set of regions of interest (ROI) that reflected the brain regions from our hypothesized collectives. One mask was created per construct (quality, social approval, reward value). All masks were created based on the coordinates of peak activation found in previous studies, as suggested by several position papers (Poldrack, 2007; Smeets et al., 2019). Each study was selected because of its close fit, either methodologically or theoretically, with the current research. For the reward value ROI mask, peak coordinates were taken from a meta-analysis by Bartra and colleagues (2013). The quality ROI mask was created using peak coordinates from Couwenberg and colleagues (2017) and Hare and colleagues (2008). The social approval ROI mask was built from peak coordinates taken from Baek and colleagues (2017) and Berns and colleagues. (2010). Peak coordinates (see appendix B for complete overview) were used to create 10mm spheres using the WFU PickAtlas tool in SPM 12 (Maldjian et al. 2003).

Next, to exclude inactive voxels from our regions of interest, we thresholded the masks on the overall treatment effect (i.e., activation at the moments of evaluation in all six conditions versus baseline). We chose as

threshold FWE correction with $p < .05$, with $k > 42$ (calculated with SPM ClusterSize Threshold) to make sure that the significant voxels were meaningful and to decrease the probability of false positives. The resultant masks (please see Figure 2.3 for an overview) contained roughly the same regions as hypothesized, which indicated activity in all regions throughout the experiment.

Figure 2.3. Thresholded ROI masks used for parameter extraction



Data extraction. The masks were used to subtract the percentage signal change between conditions for several prespecified contrasts to create parameters for testing the mediation hypotheses. Because we were interested in activity in the neural regions of interest during the specific focus conditions (i.e., social and quality focus) compared to the normal focus condition, parameters were extracted from contrasts in which activity in the focus conditions (social and quality) was corrected for the activity in the normal focus conditions (model 1 without purchase intention as parametric modulator). Parameters were extracted from the following conditions: "social focus and popularity high" versus "normal focus and popularity

high;" "social focus and popularity low" versus "normal focus and popularity low;" "quality focus and popularity high" versus "normal focus and popularity high;" "quality focus and popularity low" versus "normal focus and popularity low." Extraction was done using the MarsBar toolbox for SPM (Brett, Anton, Valabregue, & Poline, 2002). Whole brain analyses are reported in Appendix C.

Results

Behavioural results. We examined the effect of popularity on behaviour mediated by inferences of quality and social approval and moderated by the focus via a multilevel model using a moderated mediation approach (Muller, Judd, & Yzerbyt, 2005). The model was estimated with purchase intention (Y_{Intent}) as dependent variable. The predictors included popularity (X_{Pop}), social focus (MO_{So}), quality focus (MO_{Qual}), inferences of social approval (ME_{Soc}), and inferences of quality (ME_{Qual}). Due to the hierarchical nature of the model and to avoid misinterpretation of the parameters, the categorical predictors that indicated the focus (quality or social) were effect-coded (Bech & Gyrd-Hansen, 2005; O'Grady & Medoff, 1988), where focus in both cases was coded as 1, and normal focus as -1. All interactions necessary for testing for moderated mediation were included.

The effect of popularity on purchase intention and the mediators was first tested with separate models. These results (see table 2.2 for full overview) largely comply with the requirements for testing moderated mediation (Muller et al., 2005). The results for the complete model show that both inferences of social approval (βME_{Soc} = .33, p < .001) and quality (βME_{Qual} = .49, p < .001) mediated the relationship between popularity and purchase intention. The interaction between the social focus and inferences of social approval was significant and in the expected direction (βME_{Soc} x MO_{Soc} = .11, p = .011). This indicates that social inferences are particularly influential on purchase intention when people hold a social focus. There was no significant

Table 2.2.

Overview Statistics and Parameters for Behavioural Focus Effects

Model	DV: Y_{Intent}		DV: ME_{Qual}		DV: ME_{Soci}		DV: Y_{Intent}	
Predictors	*β(SE)*	*t*	*β(SE)*	*t*	*β(SE)*	*t*	*β(SE)*	*t*
Intercept	4.99 (.17)	30.18***	5.44 (.11)	47.46***	5.17 (.11)	45.96***	.60(.18)	3.37**
X_{Pop}	0.37 (.05)	7.45***	0.61 (.04)	15.34***	0.92 (.04)	21.76***	-.23(.04)	-5.37***
MO_{Soc}	-0.02 (.07)	-0.33	-0.00 (.06)	-0.05	0.13 (.06)	2.17*	-.09(.16)	-0.56
X_{Pop}*MO_{Soc}	-0.06 (.07)	-0.79	-0.12 (.06)	-2.09*	-0.18 (.06)	-2.97**	.02(.06)	0.40
MO_{Qual}	-0.11 (.07)	-1.53	-0.10 (.06)	-1.79†	-0.12 (.06)	-2.00*	-.14(.16)	-0.87
X_{Pop}*MO_{Qual}	0.07 (.07)	0.66	0.10 (.06)	1.70†	0.06 (.06)	1.05	-.05(.06)	-0.79
ME_{Soc}							.33(.03)	0.03***
ME_{Soci}*MO_{Soc}							.11(.04)	0.04**
ME_{Soc}*MO_{Qual}							.01(.04)	0.04
ME_{Qual}							.49(.03)	0.03***
ME_{Qual}*MO_{Soc}							-.10(.05)	0.05*
ME_{Qual}*MO_{Qual}							.01(.04)	0.04
Intercept [PP][a]	0.75 (.21)	3.53***	0.35 (.10)	3.41***	.33 (.10)	3.32**	.49(.14)	3.55***

[a] *Wald Z* instead of *t*. *** $p < .001$; ** $p < .01$; * $p < .05$; † $p < .10$

interaction between the quality focus and inferences of quality (βME_{Qual} x MO_{Qual} = .01, p = .749). Nonetheless, the results showed a significant negative interaction between the social focus and inferences of quality (βME_{Qual} x MO_{Soc} = -.10, p = .029). These findings indicate that participants easily inferred product quality from popularity in both the normal and quality focus and that the inferences of quality influenced choice, but that these influential effects were attenuated within a social focus. Finally, the overall treatment effect of popularity on purchase intention remained significant but became negative (βX_{Pop} = -.23, p < .001), which indicated partial mediation.

Overall, these results indicate a fairly prototypical case of moderated mediation (Muller et al., 2005). Although the results depicted an unmoderated overall treatment effect (i.e., no effect of the focus on the main effect of popularity), they also showed moderated indirect effects via the mediators on the outcome variables. These results provided partial behavioural validation for the hypotheses of this paper: there were the expected effects of social approval in the social route and an attenuation of this effect in the quality route. However, the behavioural results did not show the expected increased effects of inferences of quality when consumers hold a focus on quality.

MRI social focus. To examine the neural correlates of popularity in the social focus condition, we examined the activation in the a priori defined regions of interest in the social focus condition and compared this to activation in the normal focus condition. Parameters were extracted (as described above) and entered in a multilevel mediation model of the scores of purchase intention that were collected in the MRI scanner. Popularity (X_{Pop}) was entered as an independent variable, with the following mediators: parameters of activity in the social approval collective (ME_{ROI_Soc}), parameters of activity in the quality collective (ME_{ROI_Qual}), parameters of activity in the reward collective (ME_{ROI_Rew}), and interactions between the parameters of social approval and reward (ME_{ROI_Soc} x ME_{ROI_Rew}) and quality and reward

(ME_{Qual} x ME_{Rew}). Different parts of this model were analysed in a stepwise fashion to examine mediation before we ran the full model (see table 2.3 for a full overview of results).

We first examined the main effects of the different regions of interest on purchase intention. We found that activity in the social approval collective positively contributed to purchase intention (βME_{ROI_Soc} = .372, p = .019). Activity in the quality collective did not contribute to purchase intention (βME_{ROI_Qual} = .084, p = 661). Activity in the reward system contributed negatively to purchase intention, meaning that more activity in the reward system signalled a lower purchase intention (βME_{ROI_Rew} = -.534, p = .004). The main effect of popularity remained a significant positive contributor to purchase intention (βX_{Pop} = .750, p < .001).

Next, the relation between activity in the regions of social approval and reward value and activity in the regions of quality and reward value were analysed. The results of a multilevel model showed that activity in the social approval collective positively affected activity in the reward system (βME_{ROI_Soc} = .698, p < .001). Nevertheless, activity in the quality collective negatively affected activity in the reward value system (βME_{ROI_Qual} = -.022, p < .001). Albeit small, popularity positively affected activity in the reward value system (βX_{Pop} = .022, p < .001).

For the final model that included all mediators and interactions, the results showed that activity in the social approval collective positively contributed to purchase intention (βME_{ROI_Soc} = .368, p = .035). Moreover, there was significant interaction between the parameters of social approval and reward value, which positively linked to purchase intention (βME_{ROI_Soc} x ME_{ROI_Rew} = .875, p < .001). These results were in line with our expectations. However, contrary to our expectations, the model also showed a negative effect of activity in the reward system on purchase intention (βME_{ROI_Rew} = -.479, p = .015). The main effect of popularity remained significant (βX_{Pop} = .764, p < .001). None of the other predictors reached significance (ps > .10).

Table 2.3.

Parameters and statistics for social focus

Mediators only -> Y = Intent					
Fixed Parameters	*β*	*SE*	*df*	*t*	*p*
intercept	-.100	.082	30.015	-1.209	.236
X_{Pop}	.750	.037	1793.817	20.154	.000
ME_{Qual_ROI}	.084	.191	230.061	0.440	.661
ME_{Soc_ROI}	.372	.156	90.370	2.390	.019
ME_{Rew_ROI}	-.534	.180	129.562	-2.968	.004
Covariance Parameters	*β*	*SE*	*Wald Z*		*p*
Error term – model	2.380	.080	29.732		.000
Error term – intercept	.153	.051	2.972		.003
Mediators only -> Y = Rew. ROI					
Fixed Parameters	*β*	*SE*	*df*	*t*	*p*
intercept	.042	.060	29.959	0.697	.491
X_{Pop}	.022	.004	1773.187	6.106	.000
ME_{Qual_ROI}	-.210	.022	1791.234	-9.628	.000
ME_{Soc_ROI}	.698	.015	1796.116	48.128	.000
Covariance Parameters	*β*	*SE*	*Wald Z*		*p*
Error term – model	.021	.001	29.748		.000
Error term – intercept	.107	.028	3.841		.000
Full model incl. interactions					
Fixed Parameters	*β*	*SE*	*df*	*t*	*p*
intercept	-.242	.103	30.671	-2.349	.025
X_{Pop}	.764	.037	1783.201	20.506	.000
ME_{Qual_ROI}	.062	.200	314.433	0.312	.756
ME_{Soc_ROI}	.368	.172	99.565	2.138	.035
ME_{Rew_ROI}	-.479	.194	153.182	-2.466	.015
ME_{Qual_ROI} x ME_{Rew_ROI}	-.387	.442	506.447	-0.877	.381
ME_{Soc_ROI} x ME_{Rew_ROI}	.875	.224	807.684	3.907	.000
Covariance Parameters	*β*	*SE*	*Wald Z*		*p*
Error term – model	2.347	.079	29.678		.000
Error term – intercept	.230	.077	2.980		.003

Thus, in the social focus condition, the effect of popularity on purchase intention may be explained by activity in the social approval collective and by an interaction between activity in this collective and activity in the reward value collective. The parameters obtained here contributed positively to explaining purchase intention. Contrary to our expectations,

activity in the reward value system by itself did not contribute positively to purchase intention. Reward value appeared only to be a positive predictor if it was accompanied by activity in the social value regions.

MRI quality focus. The neural correlates of popularity in the quality condition were examined using a similar approach as in the social focus condition. Here, we examined the activation in our set of a priori defined regions of interest in the quality focus condition and compared this to activation in the normal focus condition (see table 2.4 for a full overview of results).

The results of the direct effects revealed that activity in the quality regions negatively affected purchase intention (ME_{ROI_Qual} = -.438, p = .052), and so did activity in the reward system (βME_{ROI_Rew} = -.945, p < .001). Activity in the social regions positively contributed to purchase intention (βME_{ROI_Soc} = .533, p = .001). Popularity also positively affected purchase intention (βX_{Pop} = .718, p < .001).

The results of the activity in the reward system showed that all factors positively contributed to activity in the reward system. Thus, popularity positively linked to activity in the reward system (βX_{Pop} = .024, p < .001), activity in the quality collective evoked more activity in the reward system (ME_{ROI_Qual} = .322, p < .001), and activity in the social approval collective evoked more activity in the reward system (βME_{ROI_Soc} = .553, p < .001).

The full model, which included all effects and interactions, deviated from our expectations. We found that purchase intention was negatively affected by activity in the quality collective (ME_{ROI_Qual} = -.515, p = .033). Purchase intention was also negatively affected by activity in the reward system (βME_{ROI_Rew} = -.798, p = .001). This was contrary to our expectations. Purchase intention was positively affected by activity in the social approval collective (βME_{ROI_Soc} = .557, p = .001). The main effect of popularity remained significant (βX_{Pop} = .703, p < .001). Neither of the interaction effects reached significance (ps > .10).

Table 2.4.

Parameters and test statistics for quality focus

Mediators only -> Y = Intent					
Fixed Parameters	*β*	*SE*	*df*	*t*	*p*
intercept	-.108	.094	32.100	-1.156	.256
X_{Pop}	.718	.038	1729.087	19.099	.000
ME_{Qual_ROI}	-.438	.224	158.758	-1.957	.052
ME_{Soc_ROI}	.533	.161	152.330	3.313	.001
ME_{Rew_ROI}	-.945	.221	174.210	-4.282	.000
Covariance Parameters	*β*	*SE*	*Wald Z*		*p*
Error term – model	2.248	.076	29.728		.000
Error term – intercept	.199	.064	3.133		.002
Mediators only -> Y = Rew. ROI					
Fixed Parameters	*β*	*SE*	*df*	*t*	*p*
intercept	-.019	.048	30.156	-0.389	.700
X_{Pop}	.024	.003	1775.538	7.549	.000
ME_{Qual_ROI}	.322	.023	1799.894	14.107	.000
ME_{Soc_ROI}	.553	.012	1799.680	47.929	.000
Covariance Parameters	*β*	*SE*	*Wald Z*		*p*
Error term – model	.015	.001	29.748		.000
Error term – intercept	.068	.018	3.854		.000
Full model incl. interactions					
Fixed Parameters	*β*	*SE*	*df*	*t*	*p*
intercept	-.144	.102	31.530	-1.405	.170
X_{Pop}	.703	.039	1696.383	17.975	.000
ME_{Qual_ROI}	-.515	.239	152.713	-2.157	.033
ME_{Soc_ROI}	.557	.167	162.327	3.333	.001
ME_{Rew_ROI}	-.798	.241	222.676	-3.320	.001
ME_{Qual_ROI} x ME_{Rew_ROI}	-.098	.334	852.955	-0.292	.770
ME_{Soc_ROI} x ME_{Rew_ROI}	.220	.160	1126.427	1.372	.170
Covariance Parameters	*β*	*SE*	*Wald Z*		*p*
Error term – model	2.246	.076	29.689		.000
Error term – intercept	.238	.077	3.102		.002

Thus, in the quality focus condition the positive effect of popularity on purchase intention was not explained by either activity in the quality collective or by activity in the reward system. This was contrary to what we expected: we expected that in the quality focus condition activities in both the quality collective and the reward system and an interaction between these

two would positively contribute to purchase intention. However, only the activity in the social approval collective positively affected purchase intention. These findings will be further discussed in the general discussion section below.

Assessing potential overlap. The current study distinguishes between a neural collective for approval and popularity and a neural collective for quality and popularity. At a consumer behaviour level, it has been argued that the inferences that reflect the proposed activation share similar properties that may prove to be hard to separate on a neural level (Schnuerch & Gibbons, 2014). The results discussed above demonstrate that the two routes have distinctive effects on preference; both on a behavioural and on a neural level. To test whether this holds at the neural level, conjunction analyses were applied to test for overlap in the regions that are correlated with purchase intention (Nichols et al. 2005). The conjunction analyses ($p_{uncorrected} < .005$; $k > 20$) combined the following contrasts: "quality focus and low popularity versus baseline" and "social focus and low popularity versus baseline" and the contrasts, "quality focus and high popularity versus baseline" and "social focus and high popularity versus baseline." The contrasts used here were all from the model with purchase intention as parametric modulator (model 2).

For the combination of the high popular conditions, the conjunction analysis identified a part of the lingual gyrus that was active in both the social and quality focus conditions when evaluating products high in popularity ([$x = 9$, $y = -76$, $z = -4$], $k = 104$, $p_{FWE} < .05$). The combination of the low popular conditions (social focus and quality focus) did not produce significant activation. The results indicate that the neural routes proposed for quality and approval only shared some activation for the evaluation of products high in popularity. However, the lingual gyrus is often linked to tasks such as visual and word processing, and memory activity (Leshikar, Duarte, &

Hertzog, 2012). It is thus uncertain whether the activity found via the conjunction analysis may be attributed to product popularity.

General discussion

Consumer behaviour is often heavily influenced by the choices and preferences of others, that is, by product popularity. The current study demonstrates the existence of two forms of social influence at a biological level and offers neuroscientific insights into the subjective value that consumers derive from product popularity. The study demonstrates that a single piece of information may be processed through different neural routes that reflect inferences of quality or of social approval. We found that participants who hold a social focus, compared to those who hold a normal focus, use popularity to assess expectations of social approval of the product choice, and that these expectations positively affect their purchase intention. Furthermore, we found that activity in this social approval system positively interacted with activity in the reward system and subsequently had a positive effect on the participants' preferences. These results are in line with our expectations. The current study also produced results opposite to what we had expected. We expected that with a quality focus, compared to a normal focus, activity in the quality regions would drive the effect of popularity on choice. The results show the opposite: the activity in the quality regions negatively affected purchase intention. This pattern of the neural results is partially reflected by the pattern of the inferences that were measured in the behavioural portion of the study. These latter results confirm that, similar to the neural results, consumers' preferences are indeed more informed by inferences of social approval when consumers hold a social focus. Moreover, the effect of inferences of quality was attenuated in this (social) focus. The inferences of quality did mediate the effect of popularity on preference, but this effect was not boosted when consumers held a quality focus. Finally, the

results of two conjunction analyses confirm that one can distinguish two separable neural routes of social influence.

Our findings add to the understanding of social influences in several ways. First, prior neuroscientific research on social influences often examined the impact of a popularity cue after the initial evaluation. By examining the initial response to popularity cues, we demonstrate the initial inferences that the cue evokes and offer insights beyond the conformity perspective. Consumers do not only conform to the behaviour of others after receiving feedback; they also tend to favour the popular option at the initial moment of evaluation because they expect the popular option to offer more value than the less popular option would.

We find that in situations in which consumers are focused on the quality aspects of products popularity decreases activity in the neural collective used to infer product quality and to examine the functional benefits of the option. Such a finding suggests an automatic link between popularity and quality. Parker and Lehmann (2011) noted that the link between popularity and quality seems so natural and automatic that people do not need to think about it. The results of this study are consistent with this argument; if people evaluate products the way they would normally do (i.e., normal focus), then there is more activity in the quality collective compared to when quality actually matters. This finding is further corroborated by the behavioural results. There is no indication that consumers have difficulties with drawing inferences about quality for popular products. Moreover, these drawn inferences may explain their own preferences (i.e., purchase intention) and subsequent behaviour. This would suggest a link between popularity and choice that is explained via inferences revolving around quality. As such, we would argue that a large portion of the initial subjective value of popularity might be equated with quality and functional benefits.

On the social route, we find that activity in the social approval collective positively interacts with activity in the reward system. The regions

of the brain that are part of the social collective are heavily involved with thinking about the states and opinions of others, both positive and negative ones. The neural ROIs that we selected to represent social value may be engaged when consumers assess both positive and negative feedback from others with respect to their choices (Cascio et al. 2015). We argue that the interaction between activity in the social approval collective and the reward system and its subsequent positive influence on consumers' preferences indicates that consumers use popularity to infer a positive social outcome (i.e., expectations of approval) for their choice for a popular product. Thus, consumers who use popularity for normative concerns would use popularity not out of concern for disapproval but out of expectations of approval.

Managerial implications

These results have important implications for practitioners. Popularity is often used in different sales platforms. Our results indicate that the value associated with the popular product may differ. Given the strong influence of popularity on behaviour, marketers should carefully consider the focus of consumers when they are evaluating popular products. The results we present here indicate that for fast moving consumer goods, an emphasis on the social value may be particularly effective in stimulating sales. Consumers' preferences for products are positively affected when they use popularity to assess a product's social value and carefully consider the opinions and reactions of other consumers. Consumers' preferences are negatively affected if they use popularity to assess the quality of the product. Given this, it thus seems more advisable to emphasize the social benefits of buying popular products rather than the product's quality.

Limitations and direction for future research

A possible limitation of the current study is the way participants were manipulated to hold a particular focus. It may be possible that the method

used to manipulate participants led to heightened activity in particular regions of the brain allocated to task management. Subsequently, this neural activity may have interfered with the activity in the collectives we proposed. For example, the activity in the lingual gyrus could be a result of the manipulation used. Our whole brain analyses (see appendix B) showed this region to be active not only in the instructed focus conditions (social and quality) when popularity was high, but also in the normal focus condition when popularity was low.

The current study has produced several negative results. One of these is that activity in the quality focus conditions negatively affected purchase intention compared to the normal focus condition. This result may point to a possible role of popularity as a simple heuristic that allows consumers to quickly draw inferences about a product without having to cognitively deliberate about the choice. The current experimental setup does not allow for a proper account of those effects. Future research could shed further light on the role of popularity as a heuristic by specifically examining whether the effect is the result of deliberate reasoning or automatic decision making.

The stimuli we selected for the experiment are actual products, but they were not available in the local market (at least not at the time of data collection). The evaluations and manipulations were therefore hypothetical in nature. It would be interesting to examine whether the results obtained in the current study could be linked to actual consumer behaviour (i.e., consumer choices). For example, Berns and Moore (2012) found that activity in the reward system when listening to particular songs could be linked to the songs' success in the hit charts. It would also be interesting for future research to examine whether the neural routes proposed here could also account for actual shopping behaviour in supermarkets. Such research could aid in the development of new product campaigns.

Appendix A

Instructions and manipulation

Participants first received information about the setup of the study and were explained that they were to evaluate products with different types of focus. Similar to the procedure used by Van Meer and colleagues (2017), colours were used to ease learning about the different focus conditions and to aid during the task. The combinations between colours and focus conditions were counter-balanced across the experiment.

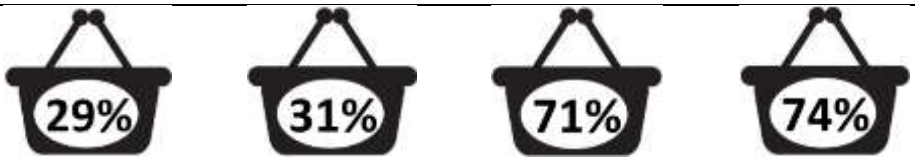
Information

In previous experiments conducted by this research project, female students evaluated a large number of new and unknown products. Their assignment was to judge the products on how suitable they were for different situations. Some products were evaluated *without specific instructions*. Other products were evaluated in terms of their suitability for situations in which *product quality* is very important or in which you *want to impress*. *Normal* focus is indicated with the colour *blue*. A *quality focus* is indicated with *red*, and *social focus* with *green*.

As an example, you could think of preparations for a dinner party or a regular party. When you cook for yourself, you pay attention to other things than when you are expecting guests. In the latter kind of situations, it could be very important to serve *high quality* products or products that will *impress your friends* and help you get their *approval*. So, you can choose products with a *normal focus*, a *quality focus*, or a *social focus*. When you evaluate products with a *normal* focus, you evaluate them as you would *normally* do. When you evaluate products with a *quality focus*, you pay attention to the *quality* of the products and how *good* they are. When you evaluate products with a *social focus*, you think of the *social approval of your friends* and if you can make a *good impression* with what you buy.

Previous participants evaluated the products from the current study with each type of focus. Some products were evaluated very well and received a high score on purchase intention. A large portion of the respondents indicated that they really wanted to buy those products. The purchase intention of the participants is expressed with a percentage. The percentage indicates how much people wanted that product. The higher the percentage, the higher the purchase intention. Below you will find some examples of how purchase intention is displayed.

Low purchase intention High purchase intention



Instructions for the task

Please evaluate the products in this task with a specific focus. The type of focus with which you need to evaluate the products is indicated with a short instruction, at the end of which you will see the colour of the focus condition. *Normal* focus is indicated with the colour *blue*, a *quality focus* is indicated with *red*, and *social focus* with *green*. The focus with which you will evaluate the products will change throughout the task. Evaluate each product with the focus of the condition. Next, please indicate your purchase intention for the product. For particular products, you need to pay attention to *social* factors, such as the *social approval* from your *social context*. In the experiment, this focus is introduced with the instruction *social focus*. For particular products, you need to pay attention to the relevance of *quality* or *taste*. These products are evaluated in terms of *quality*. In the experiment, this focus is introduced with the instruction *quality focus*. Other products you can evaluate like you would *normally* do. In the experiment, this focus is introduced with the instruction *normal focus*.

Appendix B

This section presents a full overview of the peak coordinates that were taken from previous studies (see table B2 for full list). Based upon these studies' coordinates the regions of interest for the current study were constructed.

Reward. The coordinates for the reward value mask were taken from the analysis on positively valenced outcomes by Bartra and colleagues (2013). In that analysis, the authors control for activity at the time of negatively valenced outcomes.

Quality. The coordinates for the quality mask were derived from Hare and colleagues (2008) and Couwenberg and colleagues (2017). In the latter study, the authors list coordinates of brain regions that are active when consumers evaluate functional benefits while controlling for experiential benefits.

Social. Finally, the coordinates for the approval regions were derived from Baek and colleagues (2017) who investigated social valuation during decision making (i.e. selection phase). The approval coordinates were complemented with coordinates for the anterior insula (AI) and anterior cingulate cortex (ACC) from Berns and colleagues (2010). In their study they note activation during listening to popular songs while controlling for listening to unpopular songs.

Table B1
Overview coordinates ROI Masks

Reward			
Region	*X*	*Y*	*Z*
Striatum (L)	-12	12	-6
Striatum (R)	14	12	-10
vmPFC	2	46	-8
PCC	2	-36	32
Anterior insula (L)	-32	26	0
Anterior insula (R)	32	20	-6
Brainstem	0	-20	-10
ACC	-2	24	26
Quality			
Region	*X*	*Y*	*Z*
Medial Orbitofrontal cortex	-1	27	-18
Inferior occipital gyrus (L)	-45	-70	-13
Middle temporal gyrus (R)	45	-58	6
Middle occipital gyrus (L)	-12	-94	-1
Fusiform gyrus (R)	42	-46	-20
Cingulate gyrus (R)	18	11	29
Parahippocampal gyrus (L)	-30	-1	-24
Cuneus (R)	24	-82	16
Approval			
Region	*X*	*Y*	*Z*
mmPFC (bilateral)	-9	59	4
dmPFC	-18	38	43
TPJ (L)	-51	-64	34
Precuneus (L)	-9	-55	19
Inferior temporal gyrus	66	-10	-14
Middle temporal gyrus	-60	-10	-17
Insula (L)	-33	45	36
Cingulate (L)	-9	18	42

Appendix C

This section contains an overview of the significant clusters found with whole brain analyses per condition. All analyses were conducted using a threshold of $p < .005$, with $k > 20$.

Table C1

Results Whole Brain Analysis Focus condition: Normal focus

		MNI coordinates					
Popularity low	*L*	*x*	*y*	*z*	*k*	*Z*	*p*
Lingual gyrus*	R	6	-73	-4	263	4.36	< .001
	R	15	-70	-10		4.26	< .001
Calcarine	R	18	-91	5		3.99	< .001
Superior frontal gyrus†	L	-21	35	56	92	3.95	< .001
	L	-21	17	59		3.65	< .01
	L	-15	26	59		3.22	< .01
Orbital / olfactory sulcus	L	-24	29	-19	22	3.54	< .001
	L	-3	26	-22		3.07	< .01
	L	-15	38	-19		2.88	< .01
Inferior frontal sulcus	L	-42	41	8	20	3.50	< .001
Posterior cingulate cortex	L	-6	-40	29	30	3.34	< .001
	L	-15	-49	35		2.98	< .01
	L	-9	-32	29		2.89	< .01
Popularity high							
Calcarine*	R	9	-73	2	94	3.76	< .001
	R	3	-88	2		3.33	< .001
Fusiform	R	18	-76	-10		3.32	< .001

*$p_{FWE} < .05$ at cluster-level, † $p_{FWE} < .10$ at cluster-level

In the low popularity condition, there was high activation in the lingual gyrus, which is known to be involved in visual attention and word processing (e.g., memorizing, memory retrieval). There was also a lot of activation in the superior frontal gyrus, which is known to be involved with self-awareness in coordination with the sensory system.

Table C2

Results Whole Brain Analysis Focus Condition: Quality focus

		MNI coordinates					
Popularity low	*L*	*x*	*y*	*z*	*k*	*Z*	*p*
Superior frontal sulcus	L	-21	44	44	69	3.42	< .001
	L	-12	47	38		3.22	< .01
Inferior frontal gyrus	L	-33	23	32	40	3.12	< .01
	L	-39	5	29		2.89	< .01
	L	-42	14	32		2.85	< .01
Popularity high							
Lingual gyrus*	R	9	-76	-4	217	4.77	< .001
	R	12	-67	2		4.08	< .001
Calcarine	R	6	-88	5		3.75	< .001
Superior frontal sulcus	L	-15	26	56	28	3.21	< .01
	L	-24	26	56		2.96	< .01

*p_{FWE} < .05 at cluster-level, † p_{FWE} < .10 at cluster-level

In the quality focus condition, there was a lot of activity in the lingual gyrus for products that score high in popularity but not for those that score low in popularity. This finding is in contrast to the results obtained for the normal focus.

Table C3

Results Whole Brain Analysis Focus Condition: Social focus

		MNI coordinates					
Popularity low	*L*	*x*	*y*	*z*	*k*	*Z*	*p*
Cingulate cortex	R	6	23	29	25	3.66	< .001
	L	-9	26	29		3.04	< .01
Popularity high							
Lingual gyrus*	R	9	-73	-1	685	4.29	< .001
	R	18	-70	14		4.06	< .001
Calcarine	R	3	-94	8		3.86	< .001
Inf. parietal gyrus†	L	-36	-64	53	97	4.00	< .001
Angular gyrus	L	-30	-73	44		3.68	< .001
Sup. parietal gyrus	L	-18	-67	50		2.95	< .01
Sup. Temporal sulcus	L	-57	-49	20	36	3.65	< .001
Mid. Temporal gyrus	L	-57	-40	-13	20	3.56	< .001
Mid. Frontal gyrus	L	-36	11	38	41	3.42	< .001
	L	-45	20	47		3.27	< .01
Occipital lateral gyrus	L	-24	-79	-1	28		
	L	-39	-85	-4			

*p_{FWE} < .05 at cluster-level, † p_{FWE} < .10 at cluster-level

In the social focus condition, there was again a lot of activity in the lingual gyrus when the participants evaluated products high in popularity.

Chapter 3

The certainty provided by popularity: Extending naive theories of popularity with certainty of quality

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Abstract

According to prior research, the effect of product popularity on choice is partly due to inferences about product quality and about social approval. However, these inferences do not provide a complete explanation of the effect, and prior research is inconclusive concerning the other processes that drive popular choices. The current study proposes a novel process that explains the effect of popularity on consumer choice: inferences about certainty regarding quality. Three initial studies (1A–1C) demonstrate that consumers make inferences about certainty more consistently than they do about high quality or social approval. Study 2 subsequently demonstrates the nature of the certainty construct by examining the interval of quality estimates for popular versus regular products. The results show that the choice for popular products is driven by these intervals, which are smaller for popular than for regular products. Finally, Study 3 demonstrates the mediating role of certainty in the relation between product popularity and choice. The findings provide novel insights into consumers' naïve theories of popular choice and provide ample avenues for future research.

When consumers notice that a product is popular, they may consider why this is the case and think of probable reasons. Such reasons are shaped by the naive theories that they hold. These naive theories constitute inferences in the form of common-sense explanations informed by consumers' own lay beliefs (Furnham, 1988; Kardes et al., 2004). Consumers use these lay beliefs and naive theories to make sense of their daily lives (Deval et al., 2013; Steinhart et al., 2014). When it comes to popularity information consumers may make inferences about functionality and quality (Steinhart et al., 2014), as well as in terms of expectations on how to behave and expectations of approval from social peers (Berger & Heath, 2007). The current study emphasizes the importance of inferences of functional value. In this perspective, product popularity serves as a cue that increases the certainty of a quality judgment for a product, rather than as a social cue that is used to assess approval from, or belongingness to others. There are ample studies showing that consumers may buy popular products to be part of a social group, to obtain approval from peers, or to follow a social norm (Cialdini & Goldstein, 2004). Our study distinguishes itself from such studies, and other existing studies on the tendency of uncertain consumers to choose popular products (Griskevicius et al., 2009; Griskevicius, Goldstein, Mortensen, Cialdini, & Kenrick, 2006). In the current paper we control for social inferences, drawn from popularity, and aim to show that another relevant motive to follow others stems from a functional value reason.

Consumers appear to assume that when a large group of other consumers chooses an option, this indicates that the chosen option has a high quality (Surowiecki, 2004; Bikhchandani, Hirshleifer, & Welch, 1998). This in turn affects the choice that consumers make themselves. The link between popularity and high quality has been mentioned often and at first glance seems an obvious inference for consumers to draw (Caminal & Vives, 1996; He & Oppewal, 2017; van Herpen, Pieters, & Zeelenberg, 2014), especially for

functional products as opposed to expressive products (Steinhart et al., 2014). In fact, Parker and Lehmann (2011) remark that "the link between popularity and quality is so intuitive that this inference is likely to be automatic" (p. 143).

Although prior research has empirically confirmed that inferences of quality are made for popular products (Van Herpen, Pieters, & Zeelenberg, 2009; Steinhart et al., 2014), these appear to be insufficient to completely understand the effects of popularity on choice. Recent studies have shown that the relationship between prior sales of a product and product choice is only partially mediated by quality inferences (He & Oppewal, 2017; Parker & Lehmann, 2011), leaving a large part of the effect unexplained for. Given that popularity is a strong predictor of product sales (Babić Rosario et al., 2016), it is of importance to gain further insight into the naive theories about popularity that may influence consumers' daily choices. The current study aims to provide further insights into the relationship between popularity and choice by proposing and empirically showing an additional mediating process.

Although at first glance it may seem obvious that products are popular because of high quality, there is an alternative reason for products to be popular. Popularity may not only result from high quality, but also from suiting mainstream tastes (Tucker & Zhang, 2011). A product can thus be popular because it caters to a broad range of tastes and performs reliably on many attributes. We therefore propose that product popularity signals to consumers that they can be certain that the product quality is not (too) low. This can lead to choice, as products that do not deliver the highest quality may still be preferred when their quality level is consistent and certainty about that quality is thus high (Meyer, 1981; Rust, Inman, Jia, & Zahorik, 1999). We argue that consumers are not necessarily concerned with estimating quality, but with narrowing the boundaries surrounding the quality estimate. This effect should hold even when consumers do not infer that the popular product is of a higher quality than comparable alternatives.

We propose that inferences of certainty are a consistent and key component that explains consumers' choices for popular products.

This study offers several important contributions to understanding consumers' daily decisions. First, we document for different product categories that popularity evokes more consistently inferences about certainty than about quality. We argue that consumers may likely reason that the popular taste is one that accommodates "the masses" and thus is less likely to disappoint. Our study shows that consumers estimate a narrower quality interval (i.e., they perceive higher certainty about quality) for popular than for regular products. Finally, we demonstrate that inferences about certainty offer unique insights into the relation between popularity and choice, complementing those offered by quality and social inferences.

Product popularity

A product is considered popular when it is perceived as being widely enjoyed by a large group of consumers. The larger this group becomes, the clearer it becomes that something is popular. When others subsequently see that something is popular, they assume that there must be a good reason why it is popular (Surowiecki, 2004). The presumed reason why something is popular is an inference that consumers make. Inferences are "if-then" linkages between pieces of information and a conclusion (Kardes et al., 2004). Consumers construct their own conclusions when the information presented does not offer a clear conclusion about a product (Kardes, 1988). The conclusion that people then derive at when they see that something is popular is informed by the naive theories they hold.

Naive theories are simple explanations that people use to make sense of what they encounter in their environment (Deval et al., 2013; Furnham, 1988). In the literature there are two different perspectives on why people follow others and often choose the popular option, which relates to the distinction between informational and normative influences to conform to

the behaviour of others. Deutsch and Gerard (1955) already made this distinction in influence to accept information from other consumers as evidence about reality (informational influence) versus influence to conform to expectations of others (normative influence). In the case of normative influence, the popular option is assumed to signal something about social identity when using the product (Cialdini, 2006; Cialdini et al., 1990). In the case of informational influence, consumers follow the behaviour of others because they believe that others may be correct in their choices, and thus, that the popular option may be somehow better. The popular option is assumed to signal something about the product (Banerjee, 1992; Bikhchandani et al., 1998). The current study delves into which inferences consumers exactly make about the popular product (i.e., in what way the popular product is considered a better choice).

Popularity as a signal for quality

A common perspective on the influence of popularity on choice stems from the assumption that popularity signals expectations about the performance of a product to consumers. Consumers often assume that others possess product information they themselves do not have and that following others' choices increases the probability of obtaining qualitatively better products (Banerjee, 1992; Bikhchandani et al., 1998). In other words: "if it is popular, it must be good!". This line of reasoning has informed the development of naive theories of popularity that link popularity to inferences of quality (Deval et al., 2013; Steinhart et al., 2014). In order to infer product quality, consumers assess whether a product is well made and whether the quality is consistent (Sweeney & Soutar, 2001). Earlier studies on social influence have shown that people use the popular opinion to inform such product evaluations (Burnkrant & Cousineau, 1975; Venkatesan, 1966). The popular opinion apparently signals to consumers that they can expect a higher performance from a product. Even without consumption, the

expectations result in inferences of higher quality (Muchnik et al., 2013; Pincus & Waters, 1977). Consequently, these inferences of quality can drive consumer choices (van Herpen et al., 2009). Thus, the first perspective on the relationship between popularity and choices assumes that product quality inferences are the underlying process.

However, a closer look at the studies that were just described gives rise to questions. Inferences of higher quality are mainly made when consumers note that previous people rated a product as being higher in quality. For example, Venkatesan (1966) explicitly informed participants about the evaluations of a suit by others. Cohen and Golden (1972) showed their participants the taste ratings of previous participants, and Muchnik and colleagues (2013) demonstrated how ratings drive further evaluations. It appears therefore that not popularity but a quality cue drives inferences about quality in these studies. Unfortunately, this implies that even though mere popularity has been shown to affect product sales more than quality ratings (Babić Rosario et al., 2016), our understanding of the effects of popularity is insufficient. Indeed, studies by Parker and Lehmann (2011) and He and Oppewal (2017) find that the relationship between prior purchases of other consumers and product choice is only partially mediated by quality perceptions. Consumers may thus infer that a product is popular because it outperforms other products in terms of quality. But these inferences do not fully explain the relationship between popularity and choice. This implies that potential other mediating processes may have been overlooked.

The question then remains, what other inferences may consumers make on the basis of product popularity? This question is especially relevant as a recent meta-analysis, in the context of electronic word of mouth, has indicated that the number of other consumers who adopt a product has a stronger impact on product sales than the valence (i.e., positive or negative rating) of the reviews that they provide about the product (Babić Rosario et al., 2016). In other words, the sheer popularity of products has a strong and

relevant impact on product sales, and it is thus important to understand why this effect occurs. We propose an important role for inferences about certainty.

Popularity as signal for certainty

The popular option signals what other consumers regularly choose (Cialdini, 2006; Cialdini et al., 1990). The fact that a product is chosen frequently indicates that in general it does not disappoint as it appears to properly cater to the tastes and needs of many others. Such a product is unlikely to be of the highest quality, but, at the same time, will also be unlikely to disappoint as it is able to satisfy many consumers (Tucker & Zhang, 2011). The satisfaction of many consumers likely signals that the popular product will at least not disappoint.

In terms of product positioning, a popular product caters to the preferences of a large number of consumers in the market by being in relatively close proximity to their ideal points (Dickson & Ginter, 1987). Because consumer preferences are heterogeneous, popular products need to accommodate a broad range of consumer tastes in an adequate manner. Popularity seems to indicate that the product captures the preferences of many consumers, reflected by multiple ideal points (J. K. H. H. Lee et al., 2002). The composition of multiple ideal points means that popularity is a signal for the aggregated preferences of other consumers. This implies that popularity could be a signal of high quality, but more often may increase consumers' certainty that quality is (at least) satisfactory. In terms of quality estimates and confidence intervals, popularity cues can thus both increase quality estimates and decrease the confidence interval surrounding the quality estimate (i.e., increase the perceived certainty). The latter is important because it can diminish consumer perceptions of risk about the outcome of a choice, which is an important factor in decision making (Campbell & Goodstein, 2001; Dowling & Staelin, 1994). Consumers tend to prefer

products that have a consistent performance, even if these are not of the highest quality (Meyer, 1981; Rust et al., 1999).

The notion that "popular" may not equal "high quality" exists in other areas as well. For instance, people sometimes distinguish between "popular culture" and "high culture". Although this distinction may be inadequate from an academic perspective (Parker, 2011), it illustrates the distinction that people can make between cultural products (plays, music, shows) that are enjoyed by many consumers and more high-quality products that are enjoyed by an elite with presumed superior taste. This exclusivity of products is often equated with a higher level of quality (Deval et al., 2013). Consumers may have taken up in their naïve theories this notion that popularity may not necessitate quality.

The current line of reasoning means that for naive theories of popularity, people may not necessarily infer high quality, but it is likely that they infer that "if it's popular, it will not disappoint". If other consumers would have been disappointed, the product would not have sold that well. As such, product popularity would have consumers infer that they do not need to be uncertain about its outcome. In the current study we define these inferences of certainty, drawn from popularity, in terms of the relevance of not necessarily obtaining the highest quality, but ascertaining oneself of at least not obtaining the lowest quality. We propose that the mechanism of inferences of certainty outperform the role of inferences of quality in explaining the effect of popularity on choice.

Popularity as signal for social value

A second perspective in the literature on the effects of popularity assumes that consumers look at others to determine how to behave in a way that is approved of in their close social circles (Cialdini, 2006; Cialdini & Goldstein, 2004). In these cases of normative influence, consumers conform to others out of a desire to maximize social outcomes (Campbell & Fairey,

1989) or to signal their social identity (Escalas & Bettman, 2005). In addition to approval from a close social circle, societal (moral) considerations may play a role as well. These considerations reflect what consumers infer is approved of on a larger, societal, level, that is, beliefs about what is considered right or wrong human conduct, expressed through general terms as 'good', 'bad', 'virtuous' or 'praiseworthy' (Reidenbach & Robin, 1990). Consumers that decide to pursue the popular option may not necessarily expect approval per se, but follow others because of moral considerations. For example, the effectiveness of social influences on towel reuse (Goldstein et al., 2008), is not likely to stem from expectations of immediate approval. The expected approval that consumers may infer from the popular behaviour, likely reflects approval on a societal level (Cialdini & Trost, 1998; Gigerenzer, 2010).

In sum, popularity may affect choices through inferences of approval from a close social circle and inferences of societal appropriateness. In our examination of the product inferences that consumers draw, these social inferences will be controlled for. In the next section we will demonstrate the existence of these, as well as the product-related types of inferences in the first study. This study serves as an initial investigation, which tests whether or not consumers indeed make inferences of certainty, in addition to inferences of quality and possibly social and societal approval.

Studies 1A – 1C: Inferences about certainty

Studies 1A to 1C develop evidence for the existence of inferences of certainty in response to product popularity. The studies follow the same methodology for different product categories.

Method

Undergraduate students were approached before or during the break of one of their courses and voluntarily took part in one of the studies. All

participants were above the local legal age for alcohol purchase and consumption. In Study 1A (N = 47; 87.2 % female; M_{age} = 19.16, SD = 1.77) participants evaluated an Italian wine, in Study 1B (N = 39; 79.5% female; M_{age} = 20.51, SD = 2.08) a soft French cheese, and in Study 1C (N = 36; 66.7% female; M_{age} = 20.86, SD = 1.44) a Belgian beer. These product categories were chosen because they could be part of regular grocery shopping, participants likely had experience with these types of products, and there is variation in quality of products within these product categories, ensuring the relevance of quality and certainty inferences. The popularity manipulation used was adopted from van Herpen and colleagues (2009). Participants were asked to imagine they would go to a store to buy a bottle of wine (piece of cheese, or beer). They were presented with two products that both met their demands. One of these products was noted as being popular by informing participants that it had been sold often. After participants read this text, they were asked to express their (dis-) agreement with 10 statements.

The statements reflected inferences of product quality, certainty of quality, social value and societal value, about the popular product in comparison to the other product (see Appendix A for the items). All statements were explicitly written such that the popular product was compared to the regular product (e.g., "The chance is bigger that the popular wine does not disappoint, compared to the other wine"). Agreement was expressed on 9-point scales (*-4 = completely disagree, 4 = completely agree*). The midpoint was explicitly defined as 'no difference' to ensure that deviations from the middle would reflect inferences. Study 1A served as a first, exploratory, study and contained additional background questions that were not taken along in Studies 1B and 1C (see Appendix A). Inferences were mostly measured with single items in Study 1A. Follow-up Studies 1B and 1C contained multiple item measures (except for societal value) and reliability of the scales was satisfactory, as indicated in the appendix. Mean scores for the scales were used in the analyses.

Results

Participants' ratings were analysed by one sample *t*-test's, in which the average ratings were compared against the middle of the scale (0). Table 3.1 provides mean scores and test statistics. As predicted, participants inferred the popular product would be less likely to disappoint (M_{1A} = .94, $t_{1A}(46) = 3.22$, $p < .01$; M_{1B} = 1.31, $t_{1B}(38) = 4.67$, $p < .001$; M_{1C} = .94, $t_{1C}(35) = 2.81$, $p < .01$). Participants in Study 1B inferred that the popular product was of higher quality (M_{1B} = .51, $t_{1B}(38) = 2.65$, $p < .05$) This is not the case in Study 1C (M_{1C} = -.06, $t_{1C}(35) = -.20$, $p = .842$), and in Study 1A participants inferred that the popular product was of lower quality (M_{1A} = -.67, $t_{1A}(46) = -2.57$, $p < .05$). As shown in Table 3.1, participants did not consistently make inferences about social approval from peers (only in Study 1C; Belgian beer), yet they consistently inferred appropriateness from the popularity.

Table 3.1.

Mean scores inferences based on popularity, Studies 1A – C

	1A: Wine (n = 47)		*1B: Cheese (n = 39)*		*1C: Beer (n = 36)*	
Inferences	*M (SE)*	*t(df)*	*M (SE)*	*t(df)*	*M (SE)*	*t(df)*
Quality	-0.67 (.26)*	-2.57 (46)	0.51 (.19)*	2.65 (38)	-0.06 (.28)	-0.20 (35)
Certainty	0.94 (.29)**	3.22 (46)	1.31 (.28)***	4.67 (38)	0.94 (.34)**	2.81 (35)
Social	-0.31 (.29)	-1.06 (46)	0.14 (.25)	0.58 (38)	0.99 (.25)***	3.97 (35)
Societal	0.80 (.30)*	2.59 (46)	0.71 (.29)*	2.48 (38)	0.86 (.27)**	3.15 (35)

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

Discussion

Studies 1A to 1C show that consumers *consistently* make inferences about certainty based on product popularity; the same cannot be said of inferences about quality. This supports our expectation that inferences about certainty can offer additional insights beyond those from inferences about quality. In line with our theorizing, results support that inferences of certainty need to be considered as a process mechanism for popularity effects.

In Studies 1A to 1C, our measurement of certainty focused on the expectation of a lower likelihood of poor quality. In other words, we presumed that popularity leads consumers to infer mainly that product quality is unlikely to be very low. Increased certainty could also reflect the opposite: consumers may infer that the popular product is unlikely to be of very high quality, which could then also result in more certainty about product quality. This is explained in the next study.

Study 2: A closer look at certainty intervals

Study 2 aims to examine whether the interval of popular products is indeed smaller than that of regular products, and if the interval width influences product choice such that the smaller the interval, the higher choice likelihood. In doing so, we set out to examine possible asymmetric differences in the perceived quality interval between popular versus regular products. We expect that the width of the confidence interval around quality, with the smallest intervals for popular products, drives the choice for popular products. Furthermore, we assume that primarily the low bound of the perceived quality interval increases based on product popularity (i.e., consumers assume that the product is less likely to have low quality), whereas the effect on the upper bound of the interval may be less pronounced (i.e., consumers may not necessarily assume that the product is less likely to have very high quality).

Pre-test

In order to select appropriate stimuli for study 2, we asked participants (n = 24) to evaluate four different, similar looking, wines. Participants were asked to express their agreement with statements on quality ('This wine has a good quality'), exclusivity ('This is a special wine'), and expensiveness ('This is an expensive wine'), on 9 point scales (1: completely disagree; 9: completely agree). We calculated mean scores and

compared the wines. Wines did not differ on quality ratings (M_{wine1} = 6.48, M_{wine2} = 6.61, M_{wine3} = 6.73, M_{wine4} = 6.61). Wine 1 was rated as least exclusive (M_{wine1} = 4.34) compared to the other three wines (M_{wine2} = 5.61, M_{wine3} = 5.96, M_{wine4} = 5.47, *p*s < .05). Wine 3 was perceived as the most expensive (M_{wine3} = 6.57) compared to the other wines (M_{wine1} = 5.22, M_{wine2} = 5.61, M_{wine4} = 5.96, *p*s < .08). We selected wine 2 and wine 4 because these did not significantly differ on any of the statements.

Method

Participants were recruited via flyers and an e-mail announcement. Two hundred-twenty-six undergraduate students (73.1% female; M_{age} = 20.01, *SD* = 2.59) participated in return for a snack. Participants saw two products, one of which was popular. Which product was popular and product position (left vs. right) were counterbalanced. These factors did not affect results and are not further reported.

The study was run in sessions consisting of 3 to 18 participants. They first received a verbal instruction, facilitated by a PowerPoint presentation, on how to answer questions about the quality interval of products (for details see Appendix B). The quality interval was presented as a horizontal line with endpoints *low* and *high*, on which participants indicated both the lowest and highest possible quality they would expect for a product. Participants received two examples with fictitious estimates that differed in assessments of certainty and quality.

After receiving instructions, participants were invited to fill in the questionnaire. In the questionnaire, they were asked to imagine shopping for an Italian wine and shown two pictures of bottles of wine with information on three attributes. We selected two comparable wines based on the previously discussed pretest. One of the wines was listed as popular with a sticker saying "sold the most". Participants indicated which wine they would

choose. Next, they indicated their lowest and highest perceived quality points for both wines on lines of 20 centimetres without distance indicators.

After this, participants evaluated both products on social and societal inferences, and rated their involvement in the study. Items were statements that participants were asked to agree on using 9-point scales (disagree – agree). Social value was measured by asking participants whether they expected the product to give them social approval from their peers (cf. Sweeney & Soutar, 2001). Societal value was measured by asking the extent to which the product reflected a societally accepted choice (cf. Reidenbach & Robin, 1990). We assessed participant involvement with the task with three items ("I tried to picture myself as I was really out there buying the wine; I took this scenario seriously; I read the scenario carefully"; $\alpha = .76$). Finally, we used two items ("I thought about my choice carefully; I took the choice seriously") to check participants involvement in their choice ($\alpha = .79$). Both scales were adapted from Faraji-Rad and Pham (2017). Participants' involvement was satisfactory (see Appendix B for details).

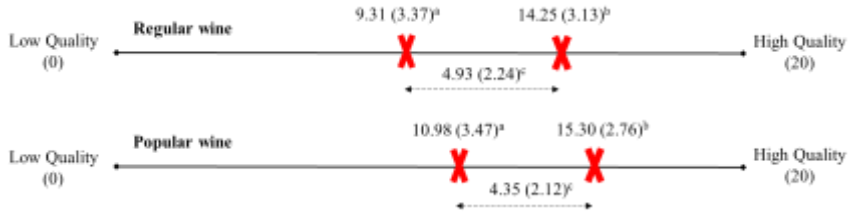
Results

Choice. A χ^2 test showed a significant association ($\chi^2(2) = 40.81$, $p < .01$, *Cramér's V* = .43) between popularity and choice. Participants chose the popular wine more often, regardless whether this was wine A (71.3 %) or wine B (71.7 %). Thus, the manipulation of popularity significantly affected participants' choice.

Quality intervals. Next, we examined the participants' quality intervals (highest quality point minus lowest point) for both the popular and regular products (see Figure 3.1). In line with our expectations, the interval for the popular product (M = 4.35 cm, SD = 2.12) was smaller than the interval for the regular product (M = 4.93 cm, SD = 2.24, $F(1, 222) = 10.61$, $p < .01$, $\eta^2_p = .05$). This was due to an increase of the lowest point, that is,

participants expected that quality would not be low for the popular product (see Figure 3.1).

Figure 3.1. Visual overview of the lower and upper quality estimates, including the interval.



Note: [a] Lower bounds significantly different ($p < .001$); [b] Upper bounds significantly different ($p < .001$); [c] Interval significantly different ($p < .01$)

To examine the potential asymmetrical nature of the interval, we examined the positions of the lower and upper bounds of the intervals. Results showed that participants set the lower quality bound of the popular product higher ($M = 10.98$, $SD = 3.47$) than that of the regular product ($M = 9.31$, $SD = 3.37$; $F(1,226) = 36.45$, $p < .001$, $\eta^2_p = .14$). Interestingly, the same applied for the upper bound of the quality score: the popular product received a higher bound ($M = 15.30$, $SD = 2.76$) than the regular product ($M = 14.25$, $SD = 3.13$; $F(1,225) = 25.58$, $p < .001$, $\eta^2_p = .10$). This indicates that the popular product was evaluated higher in quality than the regular product. Yet, as we expected, the change in the lower bound ($M = 1.59$, $SD = 4.21$) was larger than the change in the higher bound ($M = 1.04$, $SD = 3.21$; $t(219) = -3.07$, $p < .01$). The asymmetrical nature of these changes demonstrates that consumers may infer from product popularity not only that the product is of higher quality, but also that quality is more certain (i.e., the product is less likely to be of low quality).

Predicting Choice. Supporting our expectations, a logistic regression on choice (0: regular, 1: popular) with both intervals (popular and regular)

demonstrated that the larger the interval of the popular product, the less likely it was that participants chose this product ($\beta_{Popular}$ = -.19, Wald(1) = 6.58, p < .05). The regular product showed the opposite effect ($\beta_{Regular}$ = .12, Wald(1) = 2.80, p = .095), indicating that the larger the interval (i.e., if participants were less certain about the regular product's quality), the higher the likelihood that participants chose the popular product.

Discussion

Study 2 shows that popularity decreases the quality intervals of products relative to those of regular products. Results show not only that popularity offers certainty for consumers about the quality of the product, as evidenced by a smaller overall quality interval, but also that this certainty occurs because consumers infer a higher lower bound for the quality estimate. Thus, consumers are more certain that a popular product will not have a relatively low quality. Certainty does not increase due to a lower upper bound of the quality estimate, as in contrast, the upper bound for the interval is higher for a popular product than for a regular alternative. Overall, the difference in lower bound is more pronounced than the difference in the upper bound, which ensures that the quality interval for the popular product is less wide than the quality interval for the regular product. Finally, the interval width has a significant influence on the likelihood that a product will be chosen, where the smallest intervals (i.e., most certainty) lead to the highest likelihood of that product being chosen.

Study 3: Mediation of certainty inferences on choice

In Study 2, we examined the construct of certainty on its own, without a measure for perceived quality. In Study 3, we re-examined the relationship between popularity, certainty, and choice by including measures of inferred quality and social inferences. We hypothesized inferences of certainty to uniquely contribute in explaining the link between popularity and choice.

Method

Participants were recruited via flyers and an e-mail announcement. One hundred-twenty undergraduate students (75% female, M_{Age} = 20.46, *SD* = 2.57) participated in return for monetary compensation. They were randomly assigned to one of the conditions in a 3 x 2 mixed design with popularity cue as between subject factor and type of wine (A or B) as within-subject factor. In the first condition, participants saw two regular products (A vs. B), in the second condition they saw one popular product and one regular product ($A_{popular}$ vs. B), and this was counter-balanced in the third condition (A vs. $B_{popular}$).

Participants were seated in cubicles and completed the experiment on laptops. They were asked to imagine that they were preparing an Italian dinner and that they were looking for an Italian wine. Two pictures of bottles of wine were shown with information on three attributes: type of grapes, aroma, and aftertaste profile. In two of the conditions, one of the wines was listed as popular by noting high sales volume in the list of attributes. Participants chose between the two bottles of wines, and also indicated their purchase intention for both wines. Next, they evaluated both wines on four different scales that reflected the different inferences. Finally, participants were asked to judge popularity, as a manipulation check.

For the inference measurement, participants indicated their agreement to multiple items using a nine-point scale *(-4 = completely disagree to 4 = completely agree)*. Purchase intention was measured with three items adopted from Baker and Churchill (1977). Inferences of quality were measured with three items adopted from the functional value scale of Sweeney and Soutar (2001). Inferences of certainty were measured using four items of Dean and Biswas (2001). Social value was measured with four items, adopted from Sweeney and Soutar (2001). Societal value was measured with four items adopted from Reidenbach and Robin (1990). All items were reliable (α = .68 – α = .93; see Appendix B for a full overview). Inferences of

certainty and quality were mildly correlated (r_A = .41, p < .001; r_B = .33, p < .001).

Results

Manipulation check. Scores on perceived popularity were analysed with factorial repeated-measures ANOVA with type of wine (A vs. B) as within-subjects factor, and the condition as between-subjects factor. As expected, results showed a significant interaction between type of wine and condition (F(2, 117) = 103.78, p < .001, η^2_p = .64), in addition to a significant main effect of condition (F(2, 117) = 4.79, p < .05, η^2_p = .08) and no significant effect of type of wine (F(1, 117) = 1.71, p = .193, η^2_p = .01). Pairwise comparisons revealed that, as expected, in the control condition neither of the two wines was considered popular ($M_{A\_Control}$ = 5.74, $M_{B\_Control}$ = 6.14, p = .157). In the other two conditions, the wine that was manipulated as being popular was also consistently perceived as more popular, regardless of whether this was wine A ($M_{A\_Popular}$ = 7.86, $M_{B\_Regular}$ = 5.19, p < .01) or wine B ($M_{A\_Regular}$ = 4.74, $M_{B\_Popular}$ = 7.65, p < .01). These results showed that our manipulation of popularity was successful.

Inferences. For inferences of quality, ANOVA results showed a significant within-subjects effect for type of wine (F(1, 117) = 22.99, p < .001, η^2_p = .16), as well as a significant interaction with condition (F(2, 117) = 10.63, p < .001, η^2_p = .15). We found no main effect of condition on inferences of quality (F(2, 117) = .17, p = .848, η^2_p < .01). Pairwise comparisons showed that in the control condition, wine B was evaluated higher than wine A ($M_{A\_Control}$ = 6.06, $M_{B\_Control}$ = 6.68, p < .001). This effect was absent when wine A was listed as popular ($M_{A\_Popular}$ = 6.33, $M_{B\_Regular}$ = 6.19, p = .341), and present when wine B was listed as popular ($M_{A\_Regular}$ = 6.00, $M_{B\_Popular}$ = 6.75, p < .001). This indicates that without additional cues, wine B was evaluated higher in terms of quality, and that popularity of the other wine removed this effect.

For inferences of certainty, results showed no significant main effects ($F(1, 117) = .115$, $p = .735$, $\eta^2_p = .00$ for type of wine and $F(2, 117) = .72$, $p = .490$, $\eta^2_p = .01$ for condition). Yet, as expected, there was a significant interaction between type of wine and condition ($F(2, 117) = 9.850$, $p < .001$, $\eta^2_p = .14$). Pairwise comparisons showed that in the control condition, both wines were evaluated similarly ($M_{A\_Control} = 6.21$, $M_{B\_Control} = 6.55$, $p = .163$), while in the other two conditions, the popular wine scored significantly higher on inferences of certainty regardless of whether wine A ($M_{A\_Popular} = 6.94$, $M_{B\_Regular} = 6.13$, $p < .01$) or wine B ($M_{A\_Regular} = 6.05$, $M_{B\_Popular} = 6.67$, $p < .05$) was the popular wine. These results indicate that inferences of certainty resulted from product popularity.

Although not the focus of the current investigation, we also assessed inferences of social and societal value, to control for these alternative processes in our mediation analyses (see Table 3.2 for an overview of means and test statistics). For both constructs, results showed the expected interaction effect between type of wine and condition. This indicates that popularity evoked inferences of both social value and societal value.

Purchase intention. Results showed the expected interaction between type of wine and condition ($F(2, 117) = 6.17$, $p < .01$, $\eta^2_p = .10$), as well as a significant main effect for type of wine ($F(1, 117) = 8.79$, $p < .01$, $\eta^2_p = .07$) and no significant main effect for condition ($F(2, 117) = .096$, $p = .908$, $\eta^2_p = .00$). Pairwise comparisons showed that in the control condition, wine B received a higher purchase intention than wine A ($M_{A\_Control} = 5.56$, $M_{B\_Control} = 6.27$, $p < .01$). This effect was reversed and non-significant when wine A was listed as popular ($M_{A\_Popular} = 6.14$, $M_{B\_Regular} = 5.92$, $p = .264$), and reappeared when wine B was listed as popular ($M_{A\_Regular} = 5.65$, $M_{B\_Popular} = 6.20$, $p < .01$). Participants thus had higher purchase intentions for wine B than wine A, except when wine A was popular, which shows that popularity affected purchase intentions.

Table 3.2.

Means and test statistics inferences per product, Study 3

	Inferences				
	Quality	Certainty	Social	Societal	Purchase intention
Control condition					
Wine A	6.06 (1.31)[a]	6.21(1.14)	4.81 (1.62)[a]	5.76 (0.74)[b]	5.56 (1.43)[a]
Wine B	6.68 (1.18)	6.55 (0.93)	5.13 (1.90)	5.92 (0.80)	6.27 (1.21)
Wine A popular					
Wine A	6.33 (1.14)	6.94 (1.20)[a]	4.82 (1.82)	5.73 (0.99)[a]	6.14 (1.52)
Wine B	6.19 (1.14)	6.13 (0.86)	4.73 (1.78)	5.37 (0.86)	5.92 (1.62)
Wine B popular					
Wine A	6.00 (1.04)[a]	6.05 (1.05)[a]	4.51 (1.46)[a]	5.50 (1.00)[b]	5.65 (1.44)[a]
Wine B	6.75 (0.95)	6.67 (1.18)	5.28 (1.80)	5.68 (1.10)	6.20 (1.30)
Wine type					
$F(1, 117)$	22.99***	.115	18.86***	< .01	8.79**
η^2_p	.16	.001	.14	.00	.07
Condition					
$F(2, 117)$	.17	.72	.14	1.29	.10
η^2_p	< .01	.01	< .01	.02	< .01
Interaction					
$F(2, 117)$	10.63***	9.85***	10.76***	10.48***	6.17**
η^2_p	.15	.14	.16	.15	.10

* $p<.05$, ** $p<.01$, *** $p<.001$; [a] difference ($p < .05$) within condition; [b] difference ($p < .10$) within condition

Choice. A χ^2 test assessed the expected association between product popularity and choice and indeed found a significant effect ($\chi^2(2) = 20.88$, $p < .01$, *Cramér's* $V = .42$). In the control condition, participants mostly chose wine B (33% choosing A vs. 67% choosing B), while participants overwhelmingly chose wine A (70% choosing A vs. 30% choosing B) when A was the popular wine, and wine B (22 % choosing A vs. 78% choosing B) when B was the popular wine. Thus, popularity significantly influenced the choices participants made.

Mediation. We tested whether inferences about certainty and quality mediated the effect of popularity on choice, and included social and societal inferences to correct for these as potential mediators, using PROCESS model 4 (Hayes, 2013). Mediators were difference scores (evaluation of wine A

minus wine B). As we were interested in the effects of popularity on choice, the model was based on only the popularity conditions (n = 81). The results supported the proposed mediation process, as evidenced by significant indirect effects (based on 10,000 bootstraps) for both inferences about quality ($\beta_{quality}$ = 1.53, *SE* = 0.53, 95% *CI*: [0.49; 2.58]) and about certainty ($\beta_{certainty}$ = 0.43, SE = 0.21, 95% *CI*: [0.03; 0.84]). Furthermore, although popularity evoked inferences about social approval and appropriateness, these did not mediate the process ($\beta_{approval}$ = -0.37, *SE* = 0.42, 95% *CI*: [-1.20; 0.46]; $\beta_{appropriateness}$ = -0.34, SE = 0.58, 95% *CI*: [-1.48; 0.80]). The direct effect of popularity on choice remained significant ($\beta_{popularity}$ = 1.49, *SE* = 1.09, 95% *CI*: [0.16; 3.76]), indicating partial mediation by inferences about quality and certainty, but not by inferences about social approval and appropriateness.

An additional analysis examined mediation with the difference scores of purchase intention as a dependent variable. The results were similar ($\beta_{certainty}$ = 0.16, SE = 0.08, 95% CI: [0.06; 0.32]; $\beta_{quality}$ = 0.47, SE = 0.14, 95% *CI*: [0.18; 0.76]; $\beta_{approval}$ = -0.03, *SE* = 0.17, 95% *CI*: [-0.36; 0.31]; $\beta_{appropriateness}$ = -0.21, *SE* = 0.20, 95% *CI*: [-0.61; 0.19]). The direct effect of popularity on purchase intention was insignificant ($\beta_{popularity}$ = 0.25, *SE* = 0.30, 95% *CI*: [-0.34; 0.84]), which indicated full mediation of inferences about certainty and quality.

Discussion

The results of Study 3 offer further support for our predictions that popularity as a cue that triggers inferences about quality, certainty, social value, and societal value. Importantly, inferences of certainty and quality perception play a mediating role in determining intention and choice, whereas social and societal inferences do not mediate the process in this study. This further supports the importance of both quality and certainty to understand effects of product popularity.

General Discussion

Current perspectives on the naive theories of popularity primarily link its influence to inferences of product quality (Deval et al., 2013; Steinhart et al., 2014). The current study extends this knowledge and shows that although this link appears logical and automatic (Parker & Lehmann, 2011), inferences of quality are not consistently made by consumers when they are confronted with popular products, whereas inferences of certainty are consistently being made. These inferences of higher certainty for the popular product appear based on the notion that popular products are less likely to be of low quality than regular products. The interval for perceived quality is less wide for popular products, and has a higher lower bound, than for regular products. The current study demonstrates that inferences of certainty complement inferences of quality in a meaningful and insightful manner. The inclusion of certainty offers additional detailed insights into the relationship between popularity and product choice.

Our findings offer a new (product) perspective on the motives why consumers tend to follow others. Previous studies argue that consumers tend to follow others out of a fundamental biological motive to protect oneself (Griskevicius et al., 2006, 2009). The results of the current paper suggest that such herd behaviour may also arise in a product context that is void of fear appeals. Consumers may not necessarily choose the popular product out of social uncertainty but because they want to ascertain themselves of a good product.

Together, the results of this study offer important contributions to current studies on popular choice behaviour. We demonstrate that certainty is consistently inferred based on product popularity. As consumers place high value on the reliability of product performance (Meyer, 1981; Rust et al., 1999), such inferences of certainty can be crucial to their product evaluations and choice behaviour. In consumers' daily choices, product evaluations are quite often informed by the naive lay theories they hold (Furnham, 1988).

The naive theory of popularity appears to offer great potential to increase perceived certainty and thereby the perceived reliability of product quality. An evaluation of certainty will result in choice, as these allows consumers to avoid risky outcomes (Campbell & Goodstein, 2001; Dowling & Staelin, 1994). The use of different measurements to capture inferences of certainty demonstrates the ease with which consumers make these inferences. Across studies we demonstrate the consistency of the inferences of certainty that consumers make using only popularity, in contrast to inferences of quality. So, we argue that it is the link between popularity and certainty that is so intuitive that it is likely to be automatic.

Practical implications

The results of the current study have important implications for practitioners that struggle with consumers' uncertainty about products. Consider for example the introduction of foreign products to new markets. Consumers on new markets are likely unfamiliar and uncertain about such products. Communicating popularity in the foreign market could aid to reduce uncertainty and increase purchase. In addition, our results could aid the development of social marketing campaigns (Burchell et al., 2013). The fact that the popular choice is not one to disappoint could counteract beliefs such that healthy food products are less tasty. Especially for so-called sensory impaired food products, products that contain less sugar, fat or salt. Such products often suffer from a negative perceived taste, despite the health benefits. Presenting these healthier foods as popular may lead consumers to infer that the taste is not likely to disappoint and boost healthful consumption.

Popularity has a strong influence on consumers choices across a wide range of product categories (Babić Rosario et al., 2016). In the current study, the focus was on choices for food and drink products. We expect that our results replicate and generalize to other product categories. Prior studies on

the influence of product popularity, for instance regarding information cascades (Bikhchandani et al., 1998), have theorized about the choice for more durable products (e.g., cars). The main idea there is that consumers assume the probability to be higher that they end up with a car of better quality, if that type of car has been bought by others before. Just as quality inferences and choices of popular products are assumed and shown to exist across different categories ranging from key chains (Steinhart et al., 2014) to chocolates (He & Oppewal, 2017), so are inferences of certainty based on product popularity likely to occur across various categories as well. In particular for products and services for which quality may be hard to determine the inclusion of popularity cues would aid consumers. For example, consider the request of an Uber driver to verify them. That simple act of verification signals to other consumers that you were not disappointed by the driver's service, making it all the more likely that those other consumers will go for the same driver. The implementation of popularity cues in other types of services in different areas such as wellness (e.g., hairdressing or dental care) or education (e.g. workshops or masterclasses) is thus highly recommendable.

Limitations and future research

The current study offers important insights into the novel inferential mechanism of certainty, but it is also important to note its limitations. First of all, research on inferences argues that measurement-induced inference formation should be avoided, stressing the relevance for more direct inquiries of inference formation (Kardes et al., 2004). Across studies we used different measures to capture the construct of certainty and to demonstrate its properties and effect. Yet, all these measures were self-reported and this could affect the ease with which participants make inferences of certainty. Future research could focus on capturing more direct measures of consumer behaviour that may link to concepts of certainty. For example, by measuring

autonomic nervous system responses to the consumption of popular (versus regular) products, one could examine whether consumers react more calmly when consuming the popular product. Such a reaction would indicate that because consumers know that it is popular, they can be certain that the taste will be good.

An important function of consumers' naive theories is to help consumers make sense of their daily lives. We demonstrate that popularity plays a big part here, as across studies participants most often choose the popular product, irrespective of which product was popular. Yet, all studies were based on hypothetical, albeit realistic, scenarios. Participants may not always respond to hypothetical choices in the same way as they do to real choices (Shiv & Fedorikhin, 1999). A fruitful avenue for future research would be to extend the findings in the current study to more real-life situations. The question then would not be whether or not popularity can stimulate choice, but whether the popularity of products at point of purchase also evokes inferences of certainty that may explain the choice.

In addition, across studies, we reveal that consumers draw upon different naive theories, as evidenced by the inferences of societal value, and albeit to a lesser extent, social value. Although the current study focuses on the role of the product-related inferences, inferences of societal value offer explanations for popularity beyond current perspectives that emphasize social identity (Cialdini et al., 1990). Future research could examine such mechanisms by including more specific social identity properties such as social groups consumers find important (Berger & Heath, 2008). The inclusion of specific social properties could increase the relative weight given to inferences of societal value. This would make it serve as an additional complementary mechanism to explain socially-incentivized choices.

Finally, in the current paper we examined the naive theory of popularity by focussing on the mediating mechanisms that explain the effect. There may be other potential factors that can provide additional insights into

the effect. As consumers may hold multiple naive theories at once, the extent to which consumers use particular inferences may also be consumer dependent. For example, consumers who have a strong tendency to maximize may find a popularity cue very welcoming. Maximizing consumers have the tendency to look for different pieces of information revolving a product to inform their decisions. In this way, they strive to maximize decision accuracy and minimize the chance to choose of choosing the worst (Mao, 2016). Providing popularity cues would then aid maximizing consumers in making a choice.

Conclusion

In conclusion, our research shows that consumers consistently draw inferences about certainty regarding the quality of products based on popularity cues. Certainty inferences occur because consumers think that popular products are unlikely to be of low quality. Moreover, inferences about certainty offer valuable insights in the relation between product popularity and choice.

Appendix A: Materials used in Study 1A to 1C

Scenario description Study 1A: Wine / Study 1B: Cheese / Study 1C: Beer

Note: Text between brackets concerns: study 1A / study 1B / study 1C. Participants read one of these three scenarios, with the corresponding text.

Imagine yourself to be in the following situation:

You would like to (cook an Italian meal / make a cheese plate / Belgian meal) tonight. Such a recipe should of course be accompanied by an (Italian wine / French cheese / Belgian beer). You would like to get a (red wine / soft cheese / beer) and head to the (liquor store / cheese store / liquor store) to buy one. The store is filled with customers. You ask the help of one of the employees. The employee shows you two different (Italian wines / French cheeses / Belgian beers) that both meet your demands. He tells you that one of the (wines / cheeses / beers) is in very high demand and that he has sold many of those (wines / cheeses / beers).
The previous sketch contains an example in which a product is popular. Popularity may have you draw particular conclusions about the product. Below we have listed several of these conclusions. Based on the scenario sketch, could you indicate to which extent you agree with the different statements? Try to picture yourself as being part of the scenario, as much as possible, even if you normally do not (drink or buy wine / eat or buy cheese / drink or buy beer). Circle the number that expresses <u>your opinion</u> the best. Please note that there is no right or wrong answer.

Example statement

1. "The quality of the popular wine is higher than that of the other wine."

Completely disagree	-4	-3	-2	-1	0	1	2	3	4	Completely agree
					No difference					

Question only used in Study 1A

In study 1A we included an additional question to examine the ease with which participants draw particular inferences. Eight of the participants failed to answer this question. Furthermore, there was a difference in response patterns between participants. Eleven participants used one grade multiple times. Consequently, the question could not be properly analysed and was deemed unsuitable for further data collection. Hence, its exclusion in 1B and 1C.

"On the previous pages we asked you to express your opinion about several statements on conclusions people may draw about a popular choice. In the table below you find an overview of these statement, in random order. Could you indicate with conclusion you would likely draw first when you would see that a choice is popular by grading the statements? For this '1' represents really quick, ending at '8' which stands for not that fast."

Conclusion	Grade
Higher quality	
Certainty of higher quality	
Approval by friends	
Certainty of approval by friends	
Acceptance by friends	
Societally accepted choice	
Certainty wine does not disappoint	
Own reason, being ...	

Open questions Study 1A – 1C

Study 1A – 1C served as an initial foundational investigation of the different inferences consumers may draw from noting that a product is popular. As a result, we included two open-ended questionnaires (noted below). The aim of these measures was two assess whether there are other commonly-held inferences consumers draw from popularity, that we did not

derive from our theorizing. These answers however, were generally in line with our theorizing and did not offer new insights.

- "We have provided you with several conclusions that people may infer from popularity. Are there, according to you, any other conclusions people may infer from the popularity of a product or choice? If yes, what are these?"
- "What is for you the most important reason to buy a popular product?"

Table A1.

Overview statements and reliabilities of constructs Study 1A – 1C

		Reliabilities per study		
Inferences	Statements	1A	1B	1C
Quality	- The quality of the popular product is higher than that of the regular product - I am certain that the popular product is of a higher quality than the regular product - I am certain that the popular product is one of the best ones[a]	.85	.67	.75
Certainty	- It is more probable that the popular product does not disappoint, compared to the regular product - It is less probable that the popular product disappoints, compared to the regular product[a] - I am certain that the popular product is not one of the worst[a]	N/A	.56	.66
Social value	- My friends would appreciate it more if I bring the popular product, instead of the regular product - My friends would accept it more if I would bring the popular product, instead of the regular product	.81	.78	.82
Societal value	- The popular product is a more societally accepted choice than the other product	N/A	N/A	N/A

[a] Statement added in study 1B and 1C

Appendix B: Materials and checks for Study 2

Slides used during verbal instruction

Participants received verbal instructions, using PowerPoint slides, to ensure that participants understood how to answer the questions related to the quality estimates and avoid missing values. Instructions took about 5 minutes and participants were given the opportunity to ask questions.

Question 'Certainty Estimates'

"Please indicate on the lines below, as in the previously mentioned examples, with two marks per line, for each wine, what you think that both the minimum and maximum quality of the wine is. What do you think the minimum quality at least has to be *(put the mark left)*? When would you be surprised if the quality of the wines is higher *(put the mark right)*?"

Conditions and counterbalancing

There were 4 versions of the experiment. In each version, participants saw two products, one of which was popular. Which type of wine was popular and product position (left vs. right) were counterbalanced. Table B1 presents an overview of analyses (test statistics) in which we assessed whether these manipulation influenced the results. We find no effects of these manipulations on the interval.

For the lower and upper bound, there was an interaction between the popularity and wine type. Further examination of these results reveals that with respect to the lower bound, the regular wine was evaluated lower when this was the Memoria ($M_{Memoria}$ = 8.83; SD = 3.07), than when the Ripasso wine was regular ($M_{Ripasso}$ = 9.77; SD = 3.60; p < .05). Scores for the popular product

were not affected by wine type ($M_{Memoria}$ = 11.12; *SD* = 3.23; $M_{Ripasso}$ = 10.84; *SD* = 3.69; p = .538). A similar pattern applies for the upper bound. The regular wine was evaluated lower when this was the Memoria ($M_{Memoria}$ = 13.80; *SD* = 2.88), than when this was the Ripasso ($M_{Ripasso}$ = 14.57; *SD* = 3.30; $p < .05$). Scores for the popular product were not affected by wine type ($M_{Memoria}$ = 15.35; *SD* = 2.53; $M_{Ripasso}$ = 15.26; *SD* = 2.98; p = .800). Together, these results indicate that popularity had a slightly stronger effect on the Memoria wine, when it was the regular wine, than it did on the Ripasso wine. This does not affect any of the results or conclusions of the paper.

Table B1

Test statistics product popularity & product position

	Interval			*Lower bound*			*Upper bound*		
Effect	*F*	*p*	η^2_p	*F*	*p*	η^2_p	*F*	*p*	η^2_p
Popularity	10.61	.001	.05	36.45	< .001	.14	25.58	< .001	.10
Location	.61	.436	< .01	1.36	.245	.01	.42	.516	< .01
Wine Type	.03	.862	< .01	.82	.366	< .01	1.37	.24	< .01
Pop*Loc	.83	.364	< .01	.06	.808	< .01	1.57	.211	.01
Pop*Win	.29	.593	< .01	4.83	.029	.02	5.25	.023	.02

Additional questions study 2

Social value & Societal value

	Completely disagree								*Completely agree*
Wine A									
will give me social approval of my friends	-4	-3	-2	-1	0	1	2	3	4
is a societally accepted choice	-4	-3	-2	-1	0	1	2	3	4
Wine B									
will give me social approval of my friends	-4	-3	-2	-1	0	1	2	3	4
is a societally accepted choice	-4	-3	-2	-1	0	1	2	3	4

Table B2

Results analyses social and societal inferences

	Mean (SD)				
Inferences	*Regular*	*Popular*	*F*	*p*	η^2_p
Social	1.36 (1.72)	1.82 (1.68)	31.86	.000	.13
Societal	1.32 (1.50)	2.47 (1.40)	119.07	.000	.35

Choice involvement

	Completely disagree								*Completely agree*
I have carefully thought about my choice.	-4	-3	-2	-1	0	1	2	3	4
I took the choice seriously.	-4	-3	-2	-1	0	1	2	3	4

Scenario involvement

	Completely disagree								*Completely agree*
I tried to picture myself in the scenario as good as possible	-4	-3	-2	-1	0	1	2	3	4
I took the scenario seriously.	-4	-3	-2	-1	0	1	2	3	4
I read the scenario carefully	-4	-3	-2	-1	0	1	2	3	4

Table B3

Overview scores involvement

	Min	*Max*	*Mean*	*SD*
Choice involvement	.00	4.00	2.98	.79
Scenario involvement	-.67	4.00	3.03	.82

In general participants report high means of involvement (M_{Choice} = 2.98, *SD* = .79, $M_{Scenario}$ = 3.03, *SD* = .82). This indicates that participants took part seriously.

Appendix C: Materials and checks for Study 3

Scenario description study 3

"You would like to cook an Italian meal tonight. Such a recipe should of course be accompanied by an Italian wine. You would like to get a red wine and head to the liquor store to buy one. The store is filled with customers. You ask the help of one of the employees. The employee shows you two different Italian wines that both meet your demands. He tells you that one of the wines is in very high demand and that he has sold many of those wines."

Table C1

Items and reliabilities of key constructs used in study 3

		Reliability (α)	
Construct	Items	Product A	Product B
Purchase intention	- I would like to try this wine - I would like to buy this wine - I would buy this wine if I'd see it in the store	.84	.84
Quality	- This wine has a good taste - This wine is well made - This wine has an acceptable standard of quality	.75	.83
Certainty	- It is likely that this wine meets consumers' expectations - It is likely that consumers are satisfied with this wine - There is a higher chance that this wine does not disappoint compared to the other - Buying this wine is probably a good choice	.85	.81
Social value	- This wine would help me to feel accepted - This wine would improve how other people see me - This wine would make a good impression on other people - This wine would add to its owner's social approval	.90	.93
Societal value	- This wine is a societally acceptable choice - This wine is a fair choice - This wine is a just choice - This wine is a morally right choice	.68	.72
Popularity	- This product is popular - This product is in high demand	.97	.93

Additional constructs used in Study 3

We included two additional measures in Study 3; certainty of high quality, and perceived safety (i.e. least risk) of the choice. Certainty of high quality was included to assess the upper bound of the perceived quality (I am certain that wine X is of high quality; I am certain that wine X is one of the better wines; $\alpha_A = .83$, $\alpha_B = .87$). Riskiness was included to assess whether the popular choice was indeed perceived as less risky (The purchase of wine X is a fairly risky choice [reverse-coded]; The purchase of wine X is a fairly safe choice; $\alpha_A = .85$, $\alpha_B = .83$). All items were measures on 9 point scales. These measures serve as descriptive variables about the constructs of interest (inferences of quality and inferences of certainty). As we have no hypotheses about the measures, they were not included in the main body of the chapter. Results are therefore included in the appendix.

For certainty of high quality, we find a significant effect of type of wine ($F(1, 117) = 11.08$, $p < .01$, $\eta^2_p = .087$), a significant main effect of the condition ($F(2, 117) = 7.08$, $p < .01$, $\eta^2_p = .108$), and a significant interaction between these factors ($F(2, 117) = 9.30$, $p < .001$, $\eta^2_p = .145$). Pairwise comparisons revealed that in the control condition, participants were certain of the high quality of wine B, compared to wine A ($M_{A\_CONTROL} = 5.10$, $M_{B\_CONTROL} = 5.96$, $p < .01$). In the other two conditions, participants were more certain about the quality of the wine that was manipulated as being popular, regardless of whether this was wine A ($M_{A\_POPULAR} = 4.76$, $M_{B\_REGULAR} = 4.33$, $p = .097$) or wine B ($M_{A\_REGULAR} = 4.70$, $M_{B\_POPULAR} = 5.78$, $p < .001$).

For the riskiness of the choice, there was no effect of type of wine ($F(1, 117) = 1.01$, $p = .318$, $\eta^2_p = .009$). There was a (marginally) significant main effect of the condition ($F(2, 117) = 2.52$, $p = .085$, $\eta^2_p = .041$), and a significant interaction between condition and the type of wine ($F(2, 117) = 27.83$, $p < .001$, $\eta^2_p = .322$). Pairwise comparisons revealed that in the control condition, participants scored both products as equally risky ($M_{A\_CONTROL} = 4.03$, $M_{B\_CONTROL} = 4.37$, $p = .314$). In the other two conditions, participants scored

the popular wine as least risky, regardless of whether this was wine A ($M_{A\_POPULAR}$ = 2.76, $M_{B\_REGULAR}$ = 4.65, p < .001) or wine B ($M_{A\_REGULAR}$ = 4.94, $M_{B\_POPULAR}$ = 3.29, p < .001). This indicates that product popularity offers certainty to consumers and decreases the riskiness of the choice.

Table C2

Means and test statistics additional constructs, Study 3

	Certainty of high quality	*Riskiness choice*
Control condition		
Wine A	5.10 (1.27) [a]	4.03 (1.64)
Wine B	5.96 (1.40)	4.37 (1.93)
Wine A popular		
Wine A	4.76 (1.82) [b]	2.76 (.86) [a]
Wine B	4.33 (1.42)	4.65 (1.49)
Wine B popular		
Wine A	4.70 (1.33) [a]	4.94 (1.47) [a]
Wine B	5.78 (1.44)	3.29 (1.41)
Wine type		
F(1, 117)	11.08**	1.01
η^2_p	.09	.01
Condition		
F(2, 117)	7.08**	2.52†
η^2_p	.11	.04
Interaction		
F(2, 117)	9.93***	27.83***
η^2_p	.15	.32

† p < .10, * p<.05, **p<.01, ***p<.001; [a] difference (p < .05) within condition; [b] difference (p < .10) within condition

Chapter 4

Using product popularity to stimulate choice for light products in supermarkets

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Abstract

This study investigates the potential for popularity cues to stimulate consumers to choose more healthful products (versus regular products) within product categories in a supermarket context. Popularity may increase perceived product quality and perceived certainty about that quality. Healthy alternatives (i.e., light products) within a category often have a taste disadvantage compared to regular counterparts as a result of their trimmed down nutrient profiles (low in fat, sugar or salt). Because consumers are more uncertain about the taste of these light products, a popularity cue may have a larger effect on product choice for these options than on the choice for regular products. This hypothesis is tested in an experiment using virtual reality to realistically display a supermarket context. In the main experiment, a sample of 300 consumers was asked to shop for specific groceries, using existing brands and products. The results demonstrate that consumers are more likely to choose light products when these are combined with a popularity cue. In contrast, the popularity cue did not affect choice for the regular alternatives. These results have important implications for research, and public-policy makers and food retailers that aim to stimulate healthful consumption.

It is not uncommon for consumers to look at others when making food choices (Higgs & Thomas, 2016). This holds for day-to-day, low-involvement, food choices such as the content of your lunch tray at the university (Berger & Rand, 2008), as well as the contents of your shopping cart when you are out for groceries (Kuenzel & Musters, 2007). The choices of others may affect your own choices and may increase the likelihood that you make the same choice as others. The stimulating effect that popularity has on consumer choice has led to increased calls to use popularity to stimulate more healthful behaviour (Reid et al., 2010), such as more healthful food choices. After all, knowing that a product is popular among relevant others may stimulate people to choose a healthy option such as a salad over an unhealthy option such as a hamburger (Mollen, Rimal, Ruiter, & Kok, 2013). Choosing healthful food can be a choice between product categories (e.g., salads vs. hamburgers), but it can also be a choice within a category. Regular products often have counterparts that may be considered more healthful because they contain less salt, sugar or fat. The decreased levels of salt, sugar or fat ensure that the nutritional quality of light products is generally higher than the nutritional quality of regular products (Nijman et al., 2007). Although such products can be considered more healthful, the deficiency of these ingredients often leads consumers to expect that these products will be less tasty as well (Kahkönen & Tuorila, 1998). Decreased levels of salt, fat or sugar may put 'light' products at a disadvantage when they are compared with their regular full salt, fat, and sugar counterparts.

Previous research has demonstrated that product popularity increases perceived certainty about product quality (Goedegebure, Van Herpen, & Van Trijp, 2017). We posit that popularity cues should be especially relevant and impactful for products that consumers are uncertain about. If consumers are certain that the quality of a product is high, popularity cues are less informative. In contrast, if consumers are uncertain about the quality of a product, popularity cues may diminish this uncertainty

and increase product choice more readily. If this is indeed the case, light products may especially benefit from popularity cues compared to regular alternatives. Certainty about quality may be lacking for light products as their trimmed down nutrient profiles may raise doubts about their functional value. The perceived functional value of a product is made up out of elements on how a product is made (Sweeney & Soutar, 2001). In the case of food products, consumers may assume that product quality is affected when producers partly leave out fat, sugar, or salt, because these ingredients are product attributes that contribute to the expected performance of a product (Johansen, Laugesen, Janhøj, Ipsen, & Frøst, 2008). The lack of those ingredients could lead consumers to be uncertain about the taste of the product. A product about which a consumer is uncertain about may benefit from information about its popularity. Product popularity may provide the certainty consumers need, and stimulate choice.

Previous studies on social influences and the choice for (un-) healthy food products have often focused on general choices between healthy and unhealthy products such as candy bars versus granola bars (Burger et al., 2010), or rice crackers versus crisps (Salmon, Fennis, Ridder, Adriaanse, & de Vet, 2014). The current study aims to determine whether product popularity can stimulate the choice for healthful products within a product category, rather than between product categories, in a supermarket context. Whereas prior research has focused on the effects of popularity cues in general, the current study examines whether popularity has a stronger effect when consumers are more uncertain about the quality of the product (i.e., for light products) than when consumers are more certain about quality (i.e., for regular products).

Popularity and healthy food choice

It has been argued that the link between popularity and product quality is so natural, that consumers often make that connection

automatically (J. R. Parker & Lehmann, 2011). For food products, this would indicate that consumers may infer that popular foods have a higher quality and are tastier. Indeed, consumers tend to follow others in their choices when it comes to choosing the tasty option (Spiller & Belogolova, 2016). There is evidence that suggests that the knowledge that others enjoyed a food, makes consumers feel more calm (i.e., less nervous) when they are about to taste something (Schulte-Holierhoek et al., 2017). This reliance upon the taste of others goes so far that consumers shift their liking scores to those of others, such that they state higher preferences when others' preferences are high as well (Nook & Zaki, 2015). In contrast, consumers who choose something else than others are often less satisfied with their food (Ariely & Levav, 2000). Seeking alignment with the preferences and choices of others thus seems a strategy for consumers to ascertain themselves of having high quality food. Quality may be conveyed by popularity, so consumers may feel less uncertain about a popular product and also expect a higher quality of that product. Indeed, consumers infer that popular products are less likely to disappoint, compared to regular products (Goedegebure et al., 2017). Thus, consumers may use popularity cues as a tool to aid in a decision between alternatives.

A particular food choice consumers often face is the choice between a healthful and a less healthful product. Labelling a product as either healthy or unhealthy can have a strong impact on consumers' product evaluations and food choices (Irmak, Vallen, & Robinson, 2011; Okamoto et al., 2009). For light products, the decreased levels of salt, fat, or sugar could hint towards a deficit in taste (Kahkönen & Tuorila, 1998). Consumers with an interest in eating light products may choose those products either way (Zandstra, De Graaf, & Van Staveren, 2001), and consumers who are familiar with those types of products tend to signal more acceptance (Lähteenmäki, 2013). However, consumers who have no experience with the light product could become uncertain about the option (Urbany, Dickson, & Wilkie, 1989). Consequently, consumers are less likely to choose the light product. This

occurs because consumers prefer and choose products that they consider reliable and of which they can be certain that these will not disappoint (Meyer, 1981; Rust et al., 1999).

Popularity cues may increase consumers' quality estimates and offer certainty about product quality, both for regular and for light products. Yet, we propose that the magnitude of this effect is higher for light products than for regular products. As light alternatives run the risk of being perceived as uncertain and potentially disappointing, these products are likely to benefit a great deal from popularity cues. Because the popularity cue is incongruent with consumers' expectations of a taste deficit, consumers are likely to pay attention to the popularity cue and attempt to resolve the incongruity (Meyers-Levy & Tybout, 1989; Yoon, 2013). The popularity cue assures them that the product is unlikely to have an unpalatable taste, despite their potential initial doubts.

A recent meta-analysis showed that popularity can influence the choice for and intake of foods (Robinson et al., 2014). Due to heterogeneity in methodologies and measures in studies on food choice, this meta-analysis was unable to quantify the effect of popularity on food choice, although consistent evidence has been found that popularity influences food choice such that people make similar choices as others. Whether this effect is stronger for more healthful options than for unhealthy choices, as we expect, is not clear from previous research. The scarce studies in which popularity effects have been compared for healthy versus unhealthy alternatives have provided inconclusive and inconsistent evidence. For example, Burger and colleagues (2010) have demonstrated that people are more likely to choose a healthy nutrition bar over an unhealthy candy bar, when they have been presented with cues that others chose the healthy nutrition bar, and vice versa when they have been presented with cues that others chose the candy bar. In their second study, effects for the healthy bar differed significantly from the control condition whereas effects for the unhealthy bar did not, which is in

line with the idea that popularity has stronger effects for healthy alternatives. However, in another study popularity did not affect choice of more healthful products. Pliner and Mann (2004) found that participants were not (more) likely to choose a healthy light cookie than a regular cookie, despite a claim that indicated the light cookie as the popular choice. In their study, however, participants first tasted a sample of both cookies before choosing between them for a follow-up detailed evaluation and taste testing. This implies that participants in their study had first-hand experience with the light cookie, which was purposely meant to be unpalatable. Participants would then have been certain about the low quality of the light cookie. It thus remains unclear whether popularity could serve as a useful cue to stimulate choice for healthy products within a product category. In the current study we test the effectiveness of popularity in stimulating choice for light products.

Study: Shopping in a virtual supermarket

Virtual supermarket context. The current study examines popularity cues in a supermarket context. A realistic supermarket context is created by (1) using existing products on the market, (2) using a realistic representation of a choice context (supermarket shelf), and (3) testing this effect using a general sample of supermarket shoppers. A virtual shopping environment using 3D software and hardware was created to aid in the creation of a realistic supermarket context. Participants may not always respond in a similar way when seeing hypothetical (vs. real) products (Shiv & Fedorikhin, 1999). Yet, through creating a (photo-) realistic environment, constructed from actual supermarket imagery, this issue could be addressed (Galiñanes Plaza, Delarue, & Saulais, 2019). The virtual environment that is created for the current study depicts a realistic representation of a supermarket that is located in the neighbourhood of the participants and thus ensures that participants' experiences closely resemble actual choice situations.

Participants. Three hundred and thirty-four Dutch consumers participated in the study in exchange for a gift voucher of €15. A quota sample was applied, such that participants were equally divided across three age groups (18 – 35, 36 – 52, 53 – 70 years). Selection criteria ensured that all participants were responsible for doing groceries in their respective households and visited the supermarket at least once a week. None of the participants were visually handicapped. The composition of these sample characteristics was constructed in collaboration with a market research agency to ensure a representative reflection of Dutch shoppers. The market research agency recruited the participants and collected the data.

Four participants prematurely dropped out of the study during the task in virtual reality because they felt nauseous or were not able to focus. Twenty-one participants were excluded from the dataset as a result of reporting to having experienced nausea during the virtual shopping trip. This is a common issue with real-world simulations in virtual reality (LaViola, 2000). Five participants were excluded due to continuous difficulties with focusing in the virtual environment that resulted in an inability to read information. Two participants were excluded because they indicated to dislike all products in the choice set either because of maintaining a vegan diet, or other preferences. Finally, two participants were excluded because they spent a large amount of time in one of the product categories (> 5 minutes), which indicated difficulties with shopping in the virtual environment. The final sample consisted out of 300 participants (M_{age} = 44.53, SD_{age} = 15.54), 41.7 % males and 58.3 % females.

In the final sample of 300 participants, for three participants the application used for the virtual environment failed to record their choices in the product category chocolate milk. Seven participants failed to finish the survey, which results in missing values for those participants on demographics (gender and age) and the personality measures.

Design. The study used a 3 group (popularity cue: none, regular product popular, light product popular) between subjects design, which was replicated across three product categories. All participants encountered one category in which none of the options was communicated as being popular, one category in which a regular product was communicated as being popular, and one category in which a light product was communicated as being popular. The assortment of products consisted of additional options that participants could choose, next to the regular product and the light product that were communicated as popular depending on condition. The allocation of popularity to a product (i.e., control, normal or light), as well as the order in which participants encountered the product categories, were counter-balanced (cf. replicated latin-squares design, see Appendix A).

Stimuli

Product selection. Three product categories were selected that contained a light version and a regular version, in which the regular version outperformed the light version in terms of perceived quality and certainty revolving the quality. This was necessary to assess whether popularity offers a reinforcement value that may diminish the difference in perceived quality and certainty between regular and light products. This would indicate that the effect on choice may be attributed to informational social influences (Robinson et al., 2014). To rule out a normative account of the popularity effect, products were not allowed to differ on socially valenced inferences such as expected social approval and perceived social appropriateness of the choice (Higgs & Thomas, 2016).

The product selection was based on two consecutive pre-tests. In the first pre-test a sample of undergraduate students (n = 232) evaluated regular products and their light counterparts on inferences about quality, certainty about the quality, social approval, and social appropriateness. Participants were asked to agree with the following statements; quality: 'This product has

good quality'; certainty: 'This product will not likely disappoint'; social approval: 'This product will give me social approval'; social appropriateness: 'This product is a (societally) accepted choice'. All statements were answered using 9-point scales (disagree – agree). The test comprised a total of 40 products from ten different product categories. In each product category, two pairs of regular and light products from the same brand were included, thus leading to 20 product pairs in total. Each participant evaluated one pair from each of the product categories, and thus evaluated 20 products (i.e., 10 product pairs). For 17 of the 20 product pairs that were included in the dataset the results show that the regular product scored higher than the light product on inferences of quality and certainty about quality (*p*s < .05). This indicates that, in general, light products are indeed perceived as having lower quality compared to their regular counterparts. Based on the results of the first pre-test a selection was made consisting out of jams, butter for cooking, chocolate milk, soda, cheese, mayonnaise, and hot dogs. As the main experiment had a sample consisting out of regular consumers (as opposed to undergraduate students), we also tested these products in a sample of regular consumers (*n* = 199), to ensure the relevance of the product categories for our participants. Based on these results we selected a regular and light version from the categories chocolate milk, cheese and hot dogs. For these three pairs the regular products outperformed the light products in terms of inferences about quality and certainty (*p*s < .05). With respect to nutrient profiles, the light alternative was of a higher nutritional quality (cf. Nijman et al., 2007) in all cases because all light alternatives contained less fat, sugar or salt than the regular alternatives. Finally, the products selected were included in the study similar as to how they are available in the supermarket. We did not alter packaging features or product labels.

Panorama images. The virtual environment was build out of 360° panorama images that were collected in a nearby supermarket. An independent photographer made pictures of six different points in the

supermarket; the entrance, vegetable aisle, aisle with salty snacks, aisle with chocolate milk, aisle with cheese, and the aisle with the hot dogs. Shelf position of the products was kept as they were in the supermarket. The number of facings was adjusted to ensure that both target products (i.e., the regular and the light product) had a similar amount of facings to avoid that one product would be considered more popular due to its shelf space (Valenzuela, Raghubir, & Mitakakis, 2013). Please see Table 4.1 for an overview of the number of facings per product and category.

Table 4.1.

Products and numbers of facings per product category

Product (# facings)	Product Category		
	Chocolate milk	*Cheese*	*Hot Dogs*
Target products	Chocomel – regular (6) Chocomel – light (6)	Maaslander jong belegen – regular (2) Maaslander jong belegen – light (2)	Knaks regular (3) Knaks light (3)
Other products	Melkan – regular (5) Melkan – semi-skimmed (5) Melkan Skimmed (3)	Maaslander jong 30+ (1) Maaslander belegen 30+ (1) Maaslander belegen 48+ (1)	Knaks beef (1) Knaks spicy (2) Party Knaks regular (2) Party Knaks light (2)

Note: Overview of the products out of which participants could choose.

Because realistic 360° photos of the supermarket were used to build the virtual environment, participants could see more products than mentioned in Table 4.1. Yet, participants were carefully instructed to choose from the smaller set of products by giving them a specific shopping goal. For flavoured milks, participants were asked to choose a chocolate milk, while for cheese and hotdogs they were asked to choose a specific brand. These were the only products that participants could select. This was done to constrain the choice set of the participants' to five or six products and avoid large amounts of variation in choices. Please see Figure 4.1 for an overview of the assortments used, including the options available for participants and the specific instructions that were given.

Figure 4.1. Overview assortments and choices

Note: Chocomel, Melkan, Maaslander and UNOX Knaks are existing brands on the Dutch market.

Popularity. Product popularity was communicated through shelf-tags. The shelf-tags contained a picture and short description of the popular product, and a slogan saying 'sold the most' displayed in a shopping cart. Shelf-tags were designed by a design agency and pretested with 152 undergraduate students to assess if these could convey popularity in a clear and credible manner, if the shelf-tags were considered helpful, and whether they were recognizable and attractive. Based on the results we selected shelf-tags (see Figure 4.2) that outperformed other versions on these evaluations.

Figure 4.2. Overview shelf-tags used as manipulation of popularity

Note: 'Meest verkocht' = 'Sold the most'

Procedure. Data was collected by a market research company. Participants arrived at the market research company at predefined times, in groups of three to four. They were welcomed and seated in a waiting area. While seated, participants received instruction booklets and watched an

instruction video to inform them on the experimental procedures and use of the virtual software. Participants were instructed that they would go grocery shopping in a virtual representation of a local supermarket. During the trip they would be asked to make choices in five different product categories; vegetables, peanuts, cheese, chocolate milk, and hot dogs. The first two of these categories served as practice rounds to familiarize participants with the virtual environment and were presented in a fixed order. The three categories that followed were randomized.

After the instruction phase participants entered the first research room for the virtual shopping. The virtual environment was built out of 360° panorama images and participants were guided through the study using smartphones and VR headsets. Participants were seated on rotatable chairs to allow for free movement to see the environment and avoid the fear of bumping into objects in the real world. Participants completed the virtual shopping trip in groups of three to four. Each participant completed the virtual shopping trip individually and there was no interaction during the experiment.

In the virtual environment, participants entered a representation of a local supermarket at the entrance and completed a choice task at the vegetable aisle and the peanut aisle. Next, they made three choices, one in each of the experimental conditions of interest (cheese, chocolate milk, and hot dogs; see Figure 4.2 for detailed instructions). Each participant thus made a total of five choices in the virtual environment.

The navigation in the virtual environment was done via head movements. Participants were able to fully look around in the environment, from a pre-programmed fixed position. If participants wanted to obtain more information about a product they had to focus (using a fixation cross in the middle of their view) on a product for 2000 milliseconds (ms). After the 2000 ms a pop-up would appear that displayed the product and contained additional information about that product (e.g., price, weight). The pop-up

also contained a choice option and participants could indicate whether or not they wanted to buy the product by focusing (2000 ms) on one of the options (yes / no). Once participants decided to choose a product, they would automatically continue to the next choice situation in the virtual environment.

After the virtual shopping, participants were guided to a next room where they were seated behind computers. Here, they completed an evaluation task in which they evaluated the target products (i.e., the regular and the light product) that were available for choice in the product categories hot dogs, cheese, and chocolate milk.

Measures. In the virtual environment we recorded the choices of participants as well as the time spent making a choice. In the evaluation task participants indicated their purchase intention (3 items cf. Baker and Churchill Jr. (1977) ; α_{Light} = .96; $\alpha_{Regular}$ = .96), perceived product quality (3 items cf. Sweeney and Soutar (2001); α_{Light} = .93; $\alpha_{Regular}$ = .96), and perceived certainty about product quality (4 items cf. Dean and Biswas (2001); α_{Light} = .90; $\alpha_{Regular}$ = .91) for the regular target product and the light target product in each of the three categories. Participants then evaluated the perceived popularity (2 items; α_{Light} = .94; $\alpha_{Regular}$ = .95) and perceived healthiness (single item) for both products. After these product evaluations, we asked participants whether they remembered seeing a shelf tag during their shopping trip. If they indicated they had seen a shelf tag, they were asked to indicate for which product category/categories this applied, and what the shelf-tag said.

Next, participants completed several scales that measured their susceptibility to normative social influences (8 items cf. Bearden, Netemeyer and Teel (1989); α = .90), susceptibility to informative social influences (4 items cf. Bearden, Netemeyer and Teel (1989); α = .83), familiarity with light products (3 items cf. Deval et al. (2013); α = .88), relevance of eating healthy (single item), and perceived ease of use of the VR environment (4 items cf.

Venkatesh and Davis (2000); α = .89). Finally, participants reported the frequency of which they purchase products from the relevant product categories (never – daily). All items were measured on 9-point scales (see Appendix B for details).

Data analysis. For the analyses the data was restructured and the choices and evaluations of participants in the three product categories were treated as single cases. Product category was included as a control variable in all analyses. We do not have a-priori hypotheses about the effects of product category, but briefly discuss these results for completeness.

Participants' inferences were examined using repeated measures ANOVA's with the inferences for the light and the regular products as a within-subjects factor (labelled as product type), the popularity condition (control, regular popular, light popular) as a between-subjects factor, and product category as a between-subjects factor to control for category effects. Furthermore, we included all two-way and three-way interactions between product type, popularity condition, and product category. The interactions with product category were included to test whether the effect of popularity generalizes across product categories (as we expected) and to explore if effects differ in strength across categories.

The main effect of popularity on participants' choices was tested using a χ^2 test and conditional logit models with alternative specific constants, with participants' choices as dependent variable (coded as 1= other choice (reference category); 2 = regular choice; 3 = light choice). This method was chosen as it allows for factoring in that individual choices from a set of products are a function of characteristics belonging to the products (Hoffman & Duncan, 1988). The popularity condition variable was recoded, using effect-coding, into two variables to indicate the manipulation of popularity for the regular product (-1 = control; 1 = regular popular; -1 = light popular), and for the light product (-1 = control; -1 = regular popular; 1 = light popular). Product category (chocolate milk, cheese, hot dogs) was

also included as a factor to control for existing category-dependent preferences for regular or light products. The variable was effect-coded into two variables that represent the product categories cheese and chocolate, with hot dogs as the reference category. The variables were included as case-specific variables to control for all specific category-dependent preferences for all three of the options.

The experiment followed a replicated latin-squares principle. This means that participants were exposed to a popularity cue either for the first time, or for a second time. Being exposed to a cue before may have lead participants to recognize a cue more easily, and to rely upon the cue more quickly (Burke, 2018). To control for these effects, a variable for cue exposure (coded as -1 = no previous exposure; 1 = previous exposure) was included in the model that contained the main effects, category variables and the interactions. As an additional check, participants' choices were also examined for each category separately using conditional logit models (including alternative specific constants) with the same coding scheme as the analyses for the aggregated choices.

All analyses were also run with participants' susceptibility to normative social influences, susceptibility to informational social influences, familiarity with eating light products and relevance of eating healthy, as covariates. These did not affect the sign or significance of the effects of product popularity on choice and insights into the effects remained similar. We therefore only report the effects of the analyses without covariates.

Results

Sample background. Participants on average were relatively familiar with consuming light products (M = 4.97, SD = 2.11) and found it relevant to eat healthy (M = 7.58, SD = 1.29). Participants also reported that they relatively often purchase the different products in the study ($M_{chocolate\_milk}$ = 4.83, $SD_{chocolate\_milk}$ = 2.05; M_{hot_dogs} = 4.23, SD_{hot_dogs} = 2.04; M_{cheese} = 5.49, SD_{cheese}

= 2.46). Finally, despite the high number of participants who were excluded due to nausea, participants scored high on ease of use of the virtual environment (M = 7.28, SD = 1.63).

Manipulation Check. A repeated measures ANOVA was used to examine whether participants indeed perceived the light products as healthier (see Table 4.2 for an overview of the results). The light products significantly outperformed the regular products in terms of perceived healthiness ($F(1, 885) = 332.37$, $p < .001$, $\eta^2_p = .27$), indicating that the light products of the study were indeed considered more healthful alternatives. The results further showed a significant main effect of the product category ($F(2, 885) = 95.49$, $p < .001$, $\eta^2_p = .18$), and an interaction of product category with product type and the popularity condition ($F(4, 885) = 3.96$, $p < .01$, $\eta^2_p = .02$). In general, chocolate milk (M = 6.29) was perceived as most healthy, followed by cheese (M = 4.85), and hot dogs were seen as least healthy (M = 4.45; all means differ at $p < .005$). Probing the 3-way interaction showed that popularity did not affect healthiness perceptions for cheese, chocolate milk, and light hot dogs. Only for regular hot dogs perceived healthiness of was higher when regular hot dogs were labelled as popular (M = 4.30) than in the other two conditions ($M_{control}$ = 3.75, $M_{light\_popular}$ = 3.66; $p < .05$). With this one exception, popularity thus did not influence healthiness perceptions.

The perceived popularity scores were examined with a repeated measures ANOVA (see Table 4.2 for details). The results indicate that the popularity cue manipulation did no longer affect participants at the moment of evaluation. There was an effect of the product category ($F(1, 885) = 332.37$, $p < .001$, $\eta^2_p = .27$), such that some product categories were considered more popular than others. Moreover, the regular products scored significantly higher than the light products across all conditions ($F(1, 885) = 240.77$, $p < .001$, $\eta^2_p = .21$).

Overall, this means that the manipulation was not strong enough to increase the perception of popularity at the time that these questions were

answered. The items related to popularity were asked at the end of the survey, after other questions. It may be that popularity did not have a lasting effect on the evaluations, but could very well have influenced participants' choices during the experiment. In addition, participants moved from one room to another in between the virtual shopping and the questionnaire which could have affected the storage of the cue in memory. Furthermore, participants shopped in several categories which could have affected memory as well.

Table 4.2.

Scores and test statistics manipulation check

	Healthiness		*Popularity*	
Condition	*Light product*	*Regular product*	*Light product*	*Regular product*
Control	5.83 (2.18)	4.66 (2.13)	6.01 (1.80)	7.15 (1.53)
Regular popular	5.85 (2.04)	4.68 (1.92)	6.14 (1.78)	7.25 (1.43)
Light popular	5.65 (2.29)	4.49 (2.10)	5.98 (1.89)	7.24 (1.49)
Factors				
Product type	$F(1, 885) = 332.37^{***}$, $\eta^2_p = .27$		$F(1, 885) = 240.77^{***}$, $\eta^2_p = .21$	
Condition	$F(2, 885) = .806$, $\eta^2_p < .01$		$F(2, 885) = .83$, $\eta^2_p < .01$	
Category	$F(2, 885) = 95.49^{***}$, $\eta^2_p = .18$		$F(2, 885) = 1.15$, $\eta^2_p < .01$	
Product type*Condition	$F(2, 885) < .01$, $\eta^2_p < .01$		$F(2, 885) = .24$, $\eta^2_p < .01$	
Product type*Category	$F(2, 885) = .46$, $\eta^2_p < .01$		$F(2, 885) = 48.43^{***}$, $\eta^2_p = .10$	
Condition*Category	$F(4, 885) = 1.21$, $\eta^2_p = .01$		$F(4, 885) = 2.34^{\dagger}$, $\eta^2_p = .01$	
Prod. type*Cond. *Cat.	$F(4, 885) = 3.96^{**}$, $\eta^2_p = .02$		$F(4, 885) = 1.64$, $\eta^2_p < .01$	

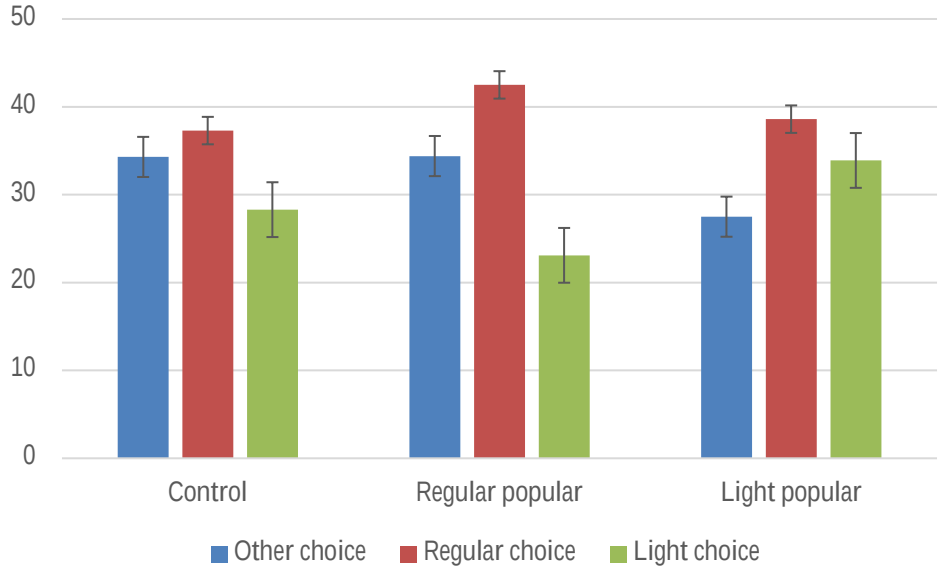
$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, $^{\dagger}p < .10$

Note. Ratings per condition represent means with standard deviations between brackets.

Choice. As an initial test, the association between participants' choices and the condition was assessed via a χ^2-test. The results (see Figure 4.3) showed a significant association between the popularity of a product and choice ($\chi^2(4) = 10.16$, $p < .05$). This demonstrated that choice was affected by popularity condition. Next, choices were analysed via a conditional logit model (see Table 4.3 for details), with the two popularity conditions entered separately as effect-coded independent variables and category as alternative-

specific effects (cf. section 2.6). The model was used to calculate choice probabilities per condition (see Table 4.4 for details).

Figure 4.3. Choice (%) per condition



The results showed that the popularity of light products significantly influenced participants' choices ($\beta_{light\text{-}pop\_vs\_control}$ = .186, p = .022). An examination of the predicted choice probabilities revealed that the probability that participants chose a light product was higher when these were popular (.34) compared to when no products were popular (.26) or when regular products were popular (.25). The baseline choice likelihood for light products differed across categories and was highest for cheese ($\beta_{light\text{-}choice\_vs\_other:cheese}$ = .420, p = .001). A separate model in which interactions between category and popularity condition were added showed that none of these interactions was significant. The effect of the popularity cue for light products thus persisted across product categories.

The results showed no significant effect of the popularity cue of the regular product ($\beta_{regular\text{-}pop\_vs\_control}$ = .050, p = .516), implying that participants were not more likely to choose a regular product when it was accompanied

by a popularity cue. Overall predicted choice probability for regular products was relatively high (.40). Baseline choice likelihood of regular products differed between categories, with highest choice likelihood for chocolate milk ($\beta_{regular\text{-}choice\_vs\_other:chocolate\_milk}$ = .701, p < .001), and interactions between category and popularity cue were not significant.

Table 4.3.

Results conditional logit effects of popularity on choice

Main effects	β	*S.E.*	*z*	*p*	95% C.I.	
Light pop vs. control	.186	.081	2.29	.022	.03	.34
Regular pop vs. control	.050	.077	0.65	.516	-.10	.20
Alt. specific effects						
Light choice vs. Other						
Chocolate milk	.111	.135	0.83	.408	-.15	.37
Cheese	.420	.122	3.45	.001	.18	.66
Intercept	-.241	.107	-2.24	.025	-.45	-.03
Regular choice vs. Other						
Chocolate milk	.701	.118	5.95	.000	.47	.93
Cheese	-.094	.119	-0.79	.427	-.33	.14
Intercept	.181	.098	1.84	.066	-.01	.37

Model: Waldχ^2(6) = 77.64, p < .001

Table 4.4.

Overview choice probabilities popularity effects

Condition		Predicted choice probability		
Product category	*Popularity*	*Other*	*Regular*	*Light*
Chocolate milk	Light popular	.213	.515	.272
	Regular popular	.220	.587	.193
	Control	.233	.562	.204
Cheese	Light popular	.262	.285	.453
	Regular popular	.294	.354	.351
	Control	.304	.331	.364
Hot Dogs	Light popular	.430	.281	.288
	Regular popular	.458	.330	.212
	Control	.472	.309	.219
Average across categories	Light popular	.302	.360	.338
	Regular popular	.324	.424	.252
	Control	.336	.401	.262

In a separate analysis, we checked whether exposure to the popularity cue for the first or the second time influenced our results. Inclusion of cue exposure in the model did not alter the sign and significance of the main effects for the other variables, nor the previously discussed category effects. Moreover, whether or not participants were exposed to a popularity cue before did not affect their choice likelihood (*p*s > .05).

Summarizing, when light products were labelled as popular, light choice increased. In contrast, when regular products were labelled as popular, regular choice did not significantly increase. These results are in line with the expectation that popularity cues have a stronger effect for light than for regular products. To more formally test whether the effect of popularity cue was stronger for light than for regular products, we compared the model of Table 4.3 with one in which popularity cue was included as a single dichotomous variable, not distinguishing between light and regular products (coded -1 = control; 1 = popularity cue). The results of the latter model revealed a significant main effect of the popularity cue (β = .115, p = .017). A likelihood-ratio test showed that the two models did not significantly differ from each other ($\chi^2(1) = 1.18$, p = .278). Thus, although the effect of popularity cue was significant for light products and non-significant for regular products, the difference between these two did not reach statistical significance.

Finally, we examined the effects of popularity for each product category separately, with a similar coding scheme for the condition as before. For an overview of participants' choices please see Table 4.5, and Figure 4.4 for a full overview of parameters and test statistics. Results in Figure 4.4 appeared to differ between product categories. This was mainly due to differences in baseline attractiveness of the products. There was a higher baseline preference for regular chocolate milk, light cheese, and "other" hotdogs. Despite these differences, the overall pattern of effects for popularity cues was similar across product categories, as evidenced by non-

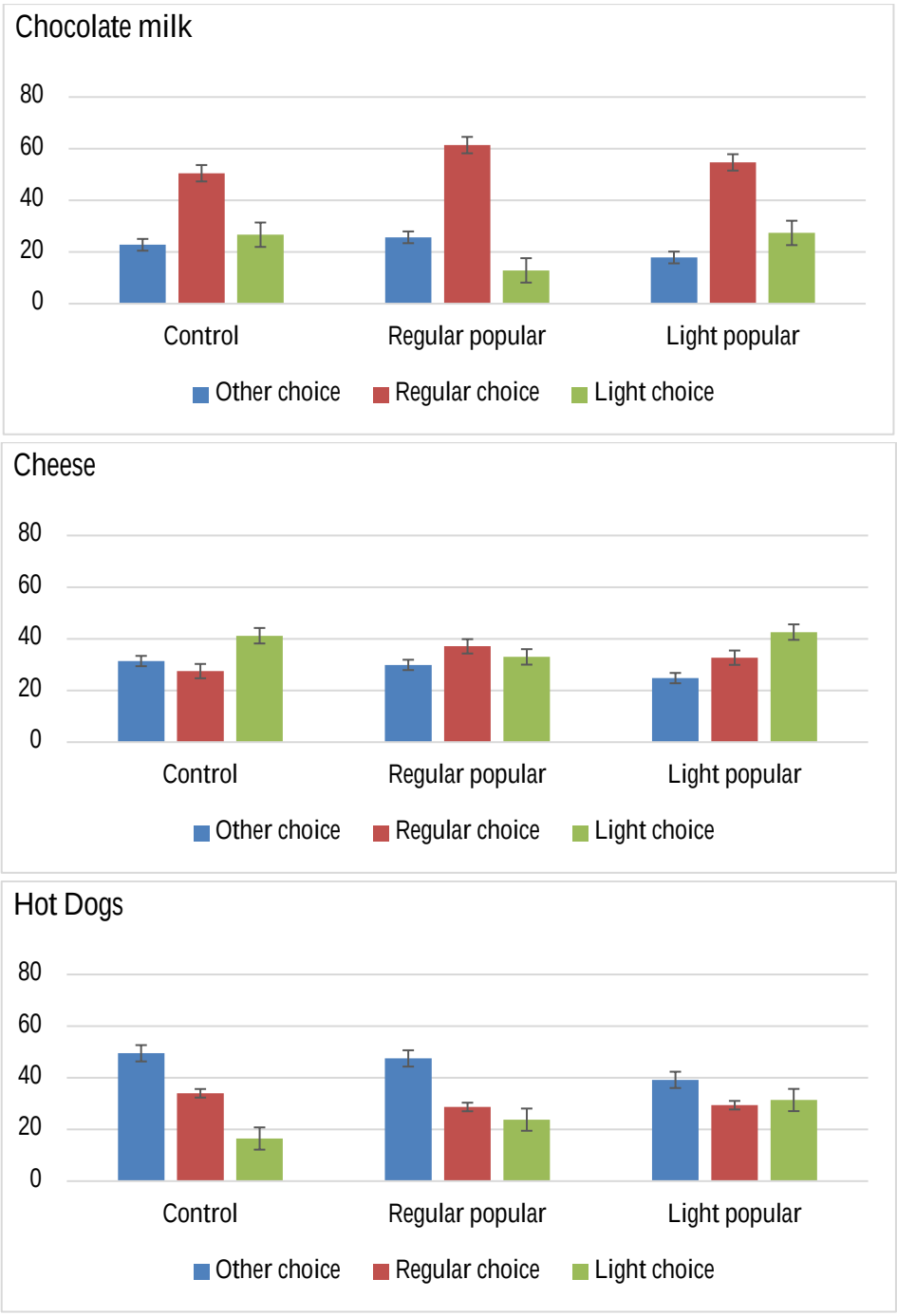
significant interactions between popularity condition and product category in the conditional logit models. In Figure 4.4, this is shown by a higher choice share of light products in the condition where light is popular than in the other conditions (green bar), and a generally higher choice share of regular products in the condition where regular is popular than in the other conditions (red bar; this pattern does not hold for hot dogs). Results of the conditional logit analyses for each product category separately were in line, although effects did not reach significance in all categories, only for the hot dogs ($\beta_{light\text{-}pop\_vs\_control}$ = .322, p = .023).

Table 4.5.

Effects of popularity cue on choice for each category separately

Chocolate Milk	β	*S.E.*	*z*	*p*	95% C.I.	
Light pop vs. control	.162	.152	1.07	.286	-0.14	0.46
Regular pop vs. control	.140	.131	1.07	.282	-0.12	0.40
Alt. specific effects						
Light choice vs. Other						
Intercept	-.116	.208	-0.56	.578	-0.52	0.29
Regular choice vs. Other						
Intercept	.820	.170	4.81	.000	0.49	1.15
Model: Waldχ^2(2) = 3.26, p = .196						
Cheese	β	*S.E.*	*z*	*p*	95% C.I.	
Light pop vs. control	.077	.130	0.59	.553	-0.18	0.33
Regular pop vs. control	.137	.135	1.01	.312	-0.13	0.40
Alt. specific effects						
Light choice vs. Other						
Intercept	.254	.169	1.51	.132	-0.08	0.58
Regular choice vs. Other						
Intercept	.027	.176	0.16	.876	-0.32	0.37
Model: Waldχ^2(2) = 1.84, p = .398						
Hot Dogs	β	*S.E.*	*z*	*p*	95% C.I.	
Light pop vs. control	.322	.141	2.28	.023	0.04	0.60
Regular pop vs. control	-.129	.137	-0.95	.344	-0.40	0.14
Alt. specific effects						
Light choice vs. Other						
Intercept	-.873	.19	-4.70	.000	-1.24	-0.51
Regular choice vs. Other						
Intercept	-.302	.16	-1.85	.064	-1.63	0.02
Model: Waldχ^2(2) = 5.44, p = .066						

Figure 4.4. Choice (%) per product category



Inferences of quality, certainty and purchase intention. Product inferences were analysed with repeated measures ANOVAs. All analyses revealed significant within-subjects effects (*p*s < .001) such that the regular product outperformed the light product on purchase intention, inferences about quality, and inferences about certainty. The results also demonstrated significant interactions between product type and product category (*p*s < .001), indicating that the difference between light and regular products was higher in some categories compared to other categories. Specifically, differences between light and regular products were most pronounced for cheese and least pronounced for chocolate milk, across all three dependent variables. None of the other effects reached significance (*p*s > .05).

Results thus showed no main effect of the popularity condition, nor an interaction between popularity and product type. This reflected the results obtained for the manipulation check of popularity. Product popularity did not influence participants' purchase intention or inferences at the moment of evaluation. As mentioned previously, the lack of effect of the popularity cue on participants' evaluations could be the result of an inability to remember the popularity cue at the moment of evaluation.

General Discussion

The present study has aimed to assess the effectiveness of popularity to serve as a cue that stimulates choices for light products in a supermarket context. A common issue with light products is that consumers often consider these products as lower in quality and taste than regular products (Kähkönen & Tuorila, 1998). This is corroborated by two pre-tests in which the regular product outperforms the light product in terms of inferences about quality and the certainty about that quality in most product categories. As a result of this difference, consumers may often opt for a regular product, in spite of health benefits of light products. The main experiment presented here contains a selection of light products that score lower on quality than

their regular counterparts. In line with our expectations, the study demonstrates that accompanying a light product with a popularity cue generally stimulates the choice for that product. This effect of popularity cue is not significant for regular products. Although the difference in effect between light and regular products has not reached significance, we can conclude that a popularity cue affects the choice for light products at the moment of choice. These results have important implications for both research and practice.

Theoretical & practical implications

The current study offers new insights on social influences in consumption choices by examining the effect of popularity on food choice from an informational social influence perspective. Previous research on social influences in consumption choices often focused on the normative properties of social influence by demonstrating the relevance of social factors such as identity signalling (Berger & Rand, 2008) and expectations of social approval (Staunton, Louis, Smith, Terry, & Mcdonald, 2014). In contrast, research on social influences in consumption choices from an informational perspective is limited (Robinson et al., 2014). The present study extends previous studies that have tended to emphasize the normative pathways by using a selection of products that suffer from a disadvantage on a functional level, but not on a social (i.e. normative) level. These light products have adjusted nutrient profiles and contain less fat, salt, or sugar, and could therefore be considered to be healthier. In comparison with regular alternatives, the light products in our study are chosen such that consumers are more uncertain about the quality, but consumers do not necessarily expect the product to be helpful in obtaining social approval, nor are the products considered a more societally approved choice. Choice for these light products significantly benefits from accompanying them with a popularity cue. This shows the potential of popularity cues to increase product choice

when consumers are uncertain about quality, and this effect should likely generalize to all products for which quality is uncertain, regardless of whether social approval is relevant as well.

The emphasis of the current study on the choice for light (versus regular) products in a supermarket setting presents a unique contribution to research. There are several studies that demonstrate that popularity may stimulate healthful consumption across categories (Burger et al., 2010; Mollen et al., 2013; Prinsen, Ridder, & de Vet, 2013). Yet, to our knowledge, the current study is one of the first to demonstrate that popularity may also stimulate healthful choice within categories. A previous study that investigated this question (Pliner & Mann, 2004) was unsuccessful in demonstrating the effectiveness of the popularity cue. This possibly occurred because participants in that study had the opportunity to taste the products before choice (which is not common in realistic choice settings). In addition to this, our study uses existing products on the market from well-known brands, whereas the products in the study by Pliner and Mann (2004) were made and labelled for that study. Their chosen labels may have negatively affected the taste evaluations of participants during the experiment (Irmak et al., 2011; Okamoto et al., 2009). The use of existing products with frequently used labels may affect perceptions of taste upfront (as demonstrated in our pre-tests). Yet, our current study shows that popularity cues are able to overcome this and to increase choice of light products in the supermarket.

Despite the positive effect of popularity cue on choice for light products, we have not found an effect on the evaluations of these products. This lack of effect of the popularity cue on the evaluations afterwards may be due to the setup of our study in which participants may have had difficulty remembering the cues that they had seen. It might also suggest that popularity may serve as a simple heuristic that participants employ when making a choice and that they do not deliberate on what the cue means (Scheibehenne, Miesler, & Todd, 2007). This study did not specifically test

whether or not popularity serves as a heuristic. Yet, given the results of the current study, popularity may be continued to be used as a tool in social marketing campaigns (Burchell et al., 2013), especially in campaigns that are focused on healthy behaviour (Reid et al., 2010).

Limitations and suggestions for future research

A limitation of the current study is that it has only examined three product categories. The current study has not found an interaction between category and popularity cue, suggesting that the effects of product popularity cues replicate across product categories. Yet, we have only examined three categories and focused on products for which social approval was less relevant. There exist other categories of supermarket products in which choices are often highly socially influenced (Kuenzel & Musters, 2007). Future research could thus further investigate the extent to which the effectiveness of popularity holds for other product categories than the ones chosen in the current paper. This question is not only interesting in terms of the replicability of our effect, but also to test potential moderators.

In the current study several product categories were targeted to examine whether popularity could evoke a switch from a regular product to a more healthful alternative. The results indicate that this is indeed the case. This suggests that consumers' diets could be improved by using popularity cues for light products. However, these improvements are also dependent upon the total purchase and consumption pattern, which is out of scope for the current study. Prior research provides mixed evidence for the potential spill-over effects from the purchase of light products on purchase and consumption from other categories. Stimulating the consumption of low-fat or low-calorie products has been found to reduce the overall fat and caloric intake (Cioffi, Levitsky, Pacanowski, & Bertz, 2015). Yet, previous studies also suggest that the choice for light products (crisps) can lead to overconsumption of those products (Cleeren, Geyskens, Verhoef, &

Pennings, 2016), or that consumption of low-fat products is not only associated with a decreased intake of fat but also an increased intake of other products with more carbohydrates and sugar (Mullie, Godderis, & Clarys, 2012). This behaviour could be the result of a licensing effect, such that consumers feel that it is justified to indulge in hedonic (i.e., unhealthy) consumption after an initial virtuous (i.e., healthy) choice (Khan & Dhar, 2006). More research is needed to determine how cues that are unrelated to health, such as the popularity cues examined in the current study, affect consumers' overall intake. Since popularity cues do not emphasize that the product is healthy, consumers may be less likely to compensate by overconsuming. If an initial healthy choice is influenced by an external cause (e.g., popularity instead of healthiness) the licensing effect may dissipate (Khan & Dhar, 2006). Further research could examine this.

The current study builds on the assumption that the effectiveness of popularity may be attributed to inferences about functional value such as certainty about quality. Previous research has indeed shown that popularity evokes inferences of quality and certainty about quality, that may influence food choices (Goedegebure et al., 2017; Van Herpen et al., 2009). However, we have been unable to demonstrate the underlying process in this experiment. Future studies could more specifically investigate the inferences consumers draw about popular light products.

All in all, the findings presented in the current study indicate that popularity may serve as a useful cue to stimulate the choice for healthier, light products in a relevant everyday setting; doing groceries in the supermarket. Retailers and policy makers can thus use popularity cues to increase healthful choices.

Appendix A

Study design

# Condition	Choice #1	Choice #2	Choice #3
1	$CM_{CONTROL}$	$HD_{REGULAR}$	CH_{LIGHT}
2	CH_{LIGHT}	$CM_{CONTROL}$	$HD_{REGULAR}$
3	$HD_{REGULAR}$	CH_{LIGHT}	$CM_{CONTROL}$
4	$CM_{REGULAR}$	HD_{LIGHT}	$CH_{CONTROL}$
5	$CH_{CONTROL}$	$CM_{REGULAR}$	HD_{LIGHT}
6	HD_{LIGHT}	$CH_{CONTROl}$	$CM_{REGULAR}$
7	CM_{LIGHT}	$HD_{CONTROL}$	$CH_{REGULAR}$
8	$CH_{REGULAR}$	CM_{LIGHT}	$HD_{CONTROL}$
9	$HD_{CONTROL}$	$CH_{REGULAR}$	CM_{LIGHT}

Note: Notation used:

Chocolate milk	$CM_{CONTROL}$ (control), $CM_{REGULAR}$ (normal popular), CM_{LIGHT} (light popular)
Hot Dogs	$HD_{CONTROL}$ (control), $HD_{REGULAR}$ (normal popular), HD_{LIGHT} (light popular)
Cheese	$CH_{CONTROL}$ (control), $CH_{REGULAR}$ (normal popular), CH_{LIGHT} (light popular)

Appendix B

Overview of items and reliabilities for the constructs

		Reliability	
Construct	*Items*	*Light*	*Regular*
Purchase intention	- I would like to try this product - I would like to buy this product - I would buy this product if I'd see it in the store	.96	.96
Quality	- This product has a good taste - This product is well made - This product has an acceptable standard of quality	.93	.96
Certainty	- It is likely that this product meets consumers' expectations - It is likely that consumers are satisfied with this product - There is a higher chance that this product does not disappoint compared to the other - Buying this product is probably a good choice	.90	.91
Popularity	- This product is popular - This product is in high demand	.94	.95
Healthiness	- This is a healthy product	N/A	N/A

Personality traits and background variables		*Reliability*
Susceptibility to normative social influence	- I rarely purchase the latest brands until I am sure my friends approve of them - It is important that others like the products and brand I buy - When buying products, I generally purchase those brands that I think others will like - If other people can see me using a product, I often purchase the brand they expect me to buy - I like to know what brands and products make good impressions on others - I achieve a sense of belonging by purchasing the same products and brands that others purchase - If I want to be like someone, I often try to buy the same brands that they buy - I often identify with other people by purchasing the same products and brands they purchase	.90
Susceptibility to informative social influence	- To make sure I buy the right product or brand, I often observe what others are buying and using - If I have little experience with a product, I often ask my friends about the product - I often consult other people to help choose the best alternative available from a product class - I frequently gather information from friends or family about a product I buy	.83
Healthy eating	- How important is it to you to eat healthy?	N/A
Familiarity light products	- I am very knowledgeable about light products - I have more experience than most people with light products - I buy light products on a regular basis	.88
Ease of use VR	- The control in the 3D environment were clear and understandable - Interacting with the store did not require a lot of mental effort. - I found it easy to shop - I find it easy to do what I want to do in the 3D environment	.89
Frequency of purchase	- Please indicate how often you buy the following products	N/A

Chapter 5

General Discussion

The overall aim of this thesis was to examine social proof in the context of product popularity. This thesis focussed specifically on the role of a single popularity cue in the daily choices of consumers to assess the potential of popularity to be implemented in campaigns and intervention strategies that contribute to consumer well-being. As such, this thesis aimed (1) to outline the neurological and psychological mechanisms that underlie the effects of popularity on choice, and (2) to unravel the different inferences that consumers may draw from popularity, in order (3) to assess the effectiveness of using popularity as a cue that stimulates healthy food choices.

Overview of main findings

In this thesis we find that there is a distinction between the informational and normative pathways through which popularity may exert an influence on consumer behaviour. First, in chapter 2 we demonstrate that there are two separate neural pathways that accompany value computation in the case of popularity. Popularity evokes two distinct types of value (assessment). The first pathway revolves around brain regions that consumers may use to assess the social consequences of a choice for popular products. The second pathway revolves around regions that consumers may use to assess the product-related consequences (i.e., what to expect in terms of performance / quality) of choosing the popular product.

Previous literature has stressed difficulties with showing that different routes actually exist. This is because it has been argued that both routes may be active at the same time and that they both contribute to explaining consumers choices. Indeed, in the current studies we find that consumers may infer product-related value as well as socially-induced value at the same time from popularity. Yet, we demonstrate in this thesis that the explanatory power of the routes is dependent upon the nature of the choice and the focus by which consumers evaluate popular products. Chapter 3 shows that consumers draw both socially-induced and product-related inferences when

noting that a food or drink product is popular, but that only the product-related pathway explains (i.e., evidence of mediation) the choices that consumers may make for a popular product. Furthermore, the results of chapter 4 indicate that especially this product-related pathway may be helpful in setting up health interventions in the domain of food choice, and that product popularity actually affects consumer choices in a daily setting; doing groceries in the supermarket.

An important result that follows from the demonstration of two separate pathways, is the finding that popularity in itself may inform consumer choice in different ways. In chapter 2 we demonstrated that consumers who hold particular mindsets, tend to choose products high in popularity because they assume that the popular products are the better choice. So, consumers that are focused on choosing products with a high social value (i.e. a social mindset), tend to choose popular products because those products are perceived to have a high social value. Interestingly, we find a different effect for consumers focused on quality. The focus on quality does not strengthen the effect of popularity. However, we do show that the popularity effect is strongest for those products that consumers are uncertain about, or at least uncertain about the quality, compared to products about which consumers are not (or less) uncertain. Chapter 4 provides further support and demonstrates that popularity stimulates the choice for light products, which again are products that consumers are relatively more uncertain about. Popularity does not influence choice for products about which there are less uncertainties. Together, the results of this thesis show that the effect of popularity may depend upon how and why a consumer evaluates products, as well as upon the type (e.g., regular versus light) of product in the choice set. Thus, this thesis shows that both the mindset of the consumer and the products in the choice set can have an influence on whether popularity exerts an effect via an informative or a normative route.

A common view on the link between popularity and choice is that the link is represented by inferences of quality or inferences of approval. However, in this thesis we show that those views do not sufficiently capture the different inferences that consumers may draw. In chapter 3 we outline multiple inferences on both sides (i.e., normative and informative) that appear to be important for consumers when it comes to popular choices. In particular on the side of product-related inferences we show that there is more than meets the eye. Consumers may not necessarily use popularity to assess quality, but (also) to assess certainty about that quality. We demonstrate that consumers do not use popularity to assess quality per se, but to limit the confidence interval that surrounds their assessment of a product's quality.

Implications: Contributions to theory

One of the major contributions of this thesis is the extended insights into the distinction between a normative and an informative account of social influence. Previous literature has suggested that these mechanisms are closely related on a theoretical level (Cialdini & Goldstein, 2004), which would prove challenging for establishing a distinction on a neural level (Schnuerch & Gibbons, 2014). Yet, in this study we successfully distinguish between the two different routes in multiple ways; by employing different measurements, employing the distinction in the experimental paradigms, and demonstrating the distinction through analyses. Previous studies that examined normative and informational accounts of social influence were often less successful in making that distinction (Toelch & Dolan, 2015). As such, the research presented here sets itself apart and can be considered a novel approach to distinguish between informational and normative social influences. Thus, the findings in this thesis provide insights into the perceived value that popularity may offer by examining the two routes of social influence. This relates to prior research in which popularity has been argued to address

biological motives such as protecting oneself (i.e., choosing for certainty and quality), as well as to impress others (i.e., obtaining approval) (Durante & Griskevicius, 2017). Previous studies on biological motives emphasized an important role of conformity and highlighted the normative pathway (Griskevicius et al., 2006, 2009). Here, we demonstrate the relevance of the informational route and show the duality of social influences. As a result, we provide a new perspective on how consumers use social information in their daily lives.

A second contribution of the thesis is the identification of previously overlooked inferences on both the informational and normative route, which contribute to the value derived from popularity. Product-related inferences that can be drawn from popularity have received little attention to date (apart from a few exceptions, see for example Parker & Lehmann (2011) and van Herpen and colleagues (2009)), yet may prove highly relevant for understanding the effect of product popularity and obtaining insights that can benefit retailers and policy makers. For product-related inferences, this research identified inferences regarding certainty about quality, as a mechanism complementary to inferences of quality. The addition of these inferences sheds new light on the perspective of why popularity influences choice, and adds an additional mechanism that can explain that relationship. Moreover, inferences about certainty explained several of the choices of the participants in the studies reported here. In addition, on the social side (i.e., the normative route) we also identified a distinction between inferences consumers may draw; inferences about social value and inferences about societal value. Taken together, the identification of these additional inferential mechanisms on both the product and social side, suggests that current perspectives on the role of social influence have provided an incomplete picture of how consumers use social information.

A third contribution of this thesis is that it provides insights into how popularity is used. Throughout the studies we presented, there are different

indications that suggest a characterization of popularity as a heuristic. Heuristics are considered to be simple rules of thumb that consumers may employ to make sense of the world and to simplify their choices (Todd & Gigerenzer, 2000). Heuristics can be employed relatively quickly, without much deliberation (Chaiken, 1980), and can still lead to optimal choices (Pohl, Erdfelder, Hilbig, Liebke, & Stahlberg, 2013). This perspective aligns with our classification of product popularity as information that can enable consumers to make sense of their environment and to inform their decisions. We see popularity as a simple cue that informs decisions relatively easily by activating naive theories that consumers hold (Deval et al., 2013; Furnham, 1988). The naive theories evoke inferences and inferences can also be drawn relatively quickly, without much cognitive effort (Kardes, 1988; Stayman & Kardes, 1992). In this thesis we consistently show that consumers use popularity to draw inferences and that these inferences can inform the choices that consumers make.

The studies reported in this thesis also make a more general contribution to marketing research. That contribution is the result of the integration of multiple streams of literature, as well as the application of various research methods. In recent years there have been several critiques on consumer research. These critiques stressed issues such as limited generalizability or a failure to incorporate theories from multiple disciplines (Pham, 2013), as well as a lack of realism in experiments and a failure to measure consumer behaviour (Morales et al., 2017). In this thesis these concerns are addressed in multiple ways. First, by combining insights from neuroscience with psychology and marketing, this thesis is able to provide a more in-depth understanding in why consumers choose popular products. This combination of methods that measure consumer behaviour on both physical and psychological levels offers great value for marketing research and understanding of consumer behaviour in particular (Shaw & Bagozzi, 2017). Furthermore, combining various novel research methods shows how

consumers are persuaded into choosing popular products in both hypothetical and realistic settings. The use of the realistic methods employed in this thesis offers great insights for retailers that base their strategies on marketing research (Burke, 2018).

Limitations & opportunities for future research

Despite the contributions of this research, the studies that are reported also had several limitations that raised questions and suggested avenues for future research. In the individual chapters we discussed the limitations that were specific to the studies in those chapters. Here, we would like to discuss three issues that apply for the thesis as a whole and raise questions and directions for future research.

The first limitation of this research is that all the studies that we report focus on initial product choices. As such, we have treated popularity as a cue that can instigate an initial product choice. In order to make a product choice, consumers evaluate what they can expect from consumption of that product and thereby assess the product's consumption value (Sheth et al., 1991). We demonstrated that for initial choices, for unknown products, popularity evokes a particular reward value that addresses different consumption values that consumers find important, namely those that reflect functionality and social consequences. Our investigation of the specific value components showed that on the product-level, the value is comprised out of certainty and quality. This aligns with the perspective of social cues as pieces of information that breed certainty about how to live (Laland, 2004). This also suggests that the value derived from popularity may be the result of an evolutionary response to that social information (Rangel et al., 2008), which can persuade consumers in making an initial choice. Yet, the question remains what happens after that initial choice, and the consumption that follows upon choice? Consumption namely affects the certainty of consumers about a product's performance (Tormala, 2016). So, consumers

with product experience have obtained product knowledge, which would eliminate the uncertainty about the product (Urbany et al., 1989). This would suggest that the need to use popularity for product-related inferences to determine certainty dissipates. In this thesis, we find that particularly for uncertain choices, popularity is an effective cue. Yet, it remains unclear what role popularity plays in product valuation after popularity instigated that first choice. Evidence suggests that consumers feel more calm when consuming unknown, yet popular, products compared to unknown unpopular products (Schulte-Holierhoek et al., 2017). This hints towards a role for popularity in the valuation of a product during consumption. Yet, future research should further investigate what happens after the initial choice, how consumption affects the value that consumers ascribe to a product and what role popularity plays in this process.

A possible line of studies could investigate the change in value by examining the specifics of the concept of uncertainty. There are different types of uncertainty, reflected by different neural circuits, in the process of noting something and actually experiencing something (Bach & Dolan, 2012). So, consumers may be uncertain about what product they see, uncertain about how that product affects their current state, or uncertain about the outcome of choosing a product. All these types of uncertainty can affect the value that consumers ascribe to a product. Consumption of a product induces learning about that product and would diminish uncertainty about that product. For products that are popular, given the duality of pathways through which popularity influences choices, it could be interesting to see if there is a shift from the informative route to the normative route when consumers move beyond the initial choice to product consumption. For example, if consumers are not uncertain about the functionality of a product, are they more worried about social consequences (e.g., possibility of approval)? Future research should thus establish how the value that consumers ascribe to popular products changes after initial consumption.

A second limitation of this thesis is related to the first limitation. In our studies the majority of the focus was on products that were not known to our participants. In the final chapter, we moved towards brands that are known to our participants, and that they come across in their daily lives. Yet, here we find that popularity effects only hold for light products, which are often chosen less and hence less known, compared to the regular counterparts. So, the question remains how popularity influences choice in situations where consumers know the products. This is particularly relevant because consumers continuously have a large amount of information at their disposal about which products are most popular (He & Oppewal, 2017). Even in a daily setting such as the supermarket, consumers can use different cues to assess the popularity of products, such as the amount of products still available (van Herpen et al., 2009), or shelf-positioning (Valenzuela & Raghubir, 2009). Our experimental approach took a step-by-step route from unknown products towards known brands. In doing so, we replicated the popularity effect along the way with different methods. This allowed us to establish and understand the effects of popularity on choice. Still, because we did not test the effect of popularity with a full range of well-known products, we do need to consider product familiarity as a limitation that could affect the generalizability of our results. So, given the availability of popularity information, future research should focus on examining the effectiveness of product popularity in settings where consumers are highly familiar with the products.

In addition, future research could also study the effectiveness of product popularity outside of the domain of fast moving consumer goods, or food products. Popularity can increase the attractiveness of low-involvement products, as suggested by literature (Kuenzel & Musters, 2007) and of course as shown in this thesis. Consumers may even choose low-involvement products because they consider it relevant for (or part of) their identity (Park & Lessig, 1977). The potential to signal a social identity and belongingness to

specific social groups drives many choices (Escalas & Bettman, 2005). There are also specific product domains where products have a higher potential to signal a social identity. In those product domains, the popularity of a product can strongly influence whether or not consumers choose that product (Berger & Heath, 2007). If many people, from different groups, all buy the same product, that product loses the ability to signal a specific social identity. In these situations, popularity would decrease the attractiveness of products.

A final limitation of the current study is that in our research designs we did not include an actual social context nor the presence of actual other consumers. We defined product popularity as a piece of information that signals that many other consumers bought or chose a particular product. In this thesis, information about popularity was mainly communicated through textual information. This communication may also be how popularity is conveyed in the real world. However, there are also instances when consumers actually see what is popular. For example, consider situations where consumers are forming long lines in front of a restaurant. Common wisdom would dictate that such a restaurant could be considered one of the better ones in the city, otherwise it would not be so busy (Surowiecki, 2004). However, consumers do not always care to be part of a crowd (Machleit, Eroglu, & Mantel, 2000) and even tend to look down upon those that are in the crowd (Pronin, Berger, & Molouki, 2007). Future studies should thus investigate the effects of popularity when actual consumers demonstrate the popularity, or are actually present.

An interesting extension here would also be to include the social context after the choice. For example, by emphasizing product consumption in a social setting such as eating with friends. The results of this thesis suggest that popularity enables consumers to impress others and obtain approval. As such, inclusion of the possibility that consumers may consume the popular product in a social setting could provide insights into whether popularity, or consumption of popular products, indeed allows consumers to impress

others and gain approval. The inclusion of a real social context may thus provide more insights into the strength of the inferential mechanisms of the effect of popularity. In this thesis we conducted one incentivized experiment (chapter 2), where consumers could get one of the products they evaluated in the experimental task. Yet, we do not know whether consumers chose a popular product because they were expecting a good quality product, or because they were planning to impress their friends or housemates with it after getting home. Inclusion of a social context could thus provide additional perspectives on the inferences that consumers may draw from popularity.

The results of our studies suggest that contextual properties such as the consumer's mindset and focus are influential in activating particular inferences, as well as determining inference strength. An interesting avenue for future research would be to determine whether there are situations in which popularity evokes multiple inferences at once, that oppose each other as a result of the contextual properties. The activation of opposing inferences from a single cue is not uncommon (Deval et al., 2013). In the case of product popularity situations may occur in which consumers infer that the popular product is of good quality. Yet, what is popular, may not always be considered as "cool" (Warren & Campbell, 2014), which would make the social value of the popular product relatively low. So, in situations where consumption is strongly equated with specific identity signals, popularity could signal high functionality of a product, while the product does not offer much chance for impressing others or getting their approval. Then again, the reverse could also occur; popular products may be highly approved, yet have very low (or bad) functionality. Finally, opposing inferences may also exist within pathways; a behaviour that is approved of by peers is not necessarily morally sound (Gigerenzer, 2010). This thesis has demonstrated that a single cue can evoke different, distinctive, inferences at once. It would be interesting to investigate situations where the activation of opposing inferences occur and to determine what is decisive in those moments.

Practical implications

The first practical implication of this thesis is the demonstration of the potential for product popularity to be employed in interventions or health campaigns that aim to stimulate healthy food choices. Previous research on social influences and health behaviour has often emphasized the normative pathway. These studies largely focus on the role of social identity (Berger & Rand, 2008), the potential of peer acceptance of the consumption (Burger, LaSalvia, Hendricks, Mehdipour, & Neudeck, 2011), or whether the consumption would be approved of (Staunton et al., 2014). Indeed, in the domain of consumption, insights on the potential of informative social influences to affect consumption is scarce (Robinson et al., 2014). By emphasizing the informative pathway, and the relevance of that pathway in influencing choice, this thesis shows that popularity can be an effective tool in health campaigns. Popularity may be particularly effective in campaigns that do not necessarily stress the socially approved nature of a behaviour, but that stress that a particular behaviour is considered better out of functional benefits. The application of popularity could stress that there is no need to be uncertain about product quality and stimulate product choice.

A second implication relates to the practical application of popularity cues. In the final experiment of this thesis, the way in which popularity was conveyed could be considered relatively subtle. Many of our participants either misremembered the cue, or completely forgot that the cue was present. Yet, popularity was effective in stimulating choice. This suggests that even subtle cues that signal the behaviour of others can be persuasive cues. Indeed, previous research has shown that traces of past behaviour (Burger et al., 2010), or even simple encounters with strangers (Ferraro, Bettman, & Chartrand, 2009) can signal popularity. Even the inclusion of images of others in marketing communications can convey popularity (Poor, Duhachek, & Krishnan, 2013). This opens up new possibilities for retailers

and policy makers as it suggests that they could avoid lengthy design procedures because popularity can be signalled in relatively simple ways.

Conclusion

The findings in this thesis show the duality of social proof in the context of product popularity. Product popularity offers consumers the chance to assess multiple consumption values of a product at once. These consumption values can explain many of the daily choices that consumers make. The examination of two routes of social influence, on a psychological and neural level, offers a good starting point for future research to examine consumer decision making in a social context, and in particular to further examine the potential of using social information to stimulate consumer well-being.

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Summary

Consumers often look at the behaviour of others to inform their own choices. As a result, many of consumers' daily decisions are socially influenced. The current thesis addresses the question of why consumers choose what others have chosen before. Specifically, this thesis focuses on the effect of product popularity (i.e., the widespread adoption of a single product) on consumer choice. The main premise throughout the thesis is that product popularity conveys value. The specific nature of that value is dependent upon whether consumers examine the popular product to assess the functional value (i.e., informational social influence), the social value (i.e., normative social influence), or both types at once. The general introduction in Chapter 1 lays the foundation for the studies of the thesis and outlines the general objectives. The overall aim of the research is to use the distinction between informational and normative social influence to examine how a single popularity cue can influence consumer choices, and to assess the potential of product popularity as a tool to positively influence consumer well-being.

Chapter 2 explores the neurological and psychological mechanisms that underlie the effects of popularity on preference and behaviour. The results of the chapter extend insights on the distinction between two routes of social influence; normative and informational social influences. To demonstrate that distinction, the chapter draws upon insights from consumer mindsets. The results show that consumers who adopt a social (versus normal) mindset or a quality (versus normal) mindset use popularity to derive value differently. The value derived in a social mindset is made up out of inferences of social approval and general reward value, and positively affects consumer preferences. The value derived with a quality mindset is made up out of inferences of quality and negatively affects preferences. The study confirms the existence of two distinct patterns on a neurological level, reflected by different brain regions, and on a psychological level, reflected by different inferences. These two patterns represent the two routes of social

influence. The existence of these two routes provides the first evidence of the duality of the value that consumers may ascribe to popular products.

The specifics of the psychological meaning of the value that consumers ascribe is explored in chapter 3. This chapter examines the inferences that consumers may draw from popularity from the perspective of consumer naive theories. Naive theories are layman theories that explain how consumers make sense of their daily lives and daily choices. The chapter identifies novel inferential mechanisms that provide further insights in why popularity drives choice. For normative social influence, the chapter identifies the inferential mechanism of societal value that operates next to the mechanism of social value (i.e., social approval). For informational social influence, the chapter provides an account of the inferential mechanism of certainty about quality that operates next to inferences of quality. The chapter further explores the mechanism of certainty. The logic behind that mechanism is that popularity signals choices of a majority of consumers with heterogeneous preferences. The results of five experiments demonstrate the consistency with which consumers make the inference about certainty. The concept of certainty about quality represents the confidence interval surrounding quality. As such, it can be considered a complementary mechanism that further aids in unravelling the value that consumers may ascribe to popular products.

The results discussed above form the foundation for chapter 4, which explores the potential for product popularity to stimulate healthy food choices. Specifically, the study focusses on stimulating the choice for healthful alternatives that have a taste disadvantage as a result of their trimmed down nutrient profiles (low in fat, sugar or salt). The results of two pre-tests show that regular products often outperform light products in terms of inferences about quality and the certainty about that quality. The study further builds on the premise that the value ascribed to popularity reflects functional value that can accommodate concerns about quality. The

main experiment tests the premise in a virtual, 3D representation of a local supermarket. The results show that consumers are more likely to choose light products when these are accompanied by a popularity cue. In contrast, choice of regular products does not increase when these are accompanied by a popularity cue. The findings offer support for using product popularity to stimulate healthful consumer choices.

Finally, the discussion in chapter 5 provides an overview of the main findings of this thesis and discusses implications for theory and practice. Overall, this thesis demonstrates the duality of the value that consumers may ascribe to popular products. By drawing on insights from different scientific disciplines, and combining different research methods, the thesis confirms that popularity offers consumers the chance to assess multiple consumption values at once. These consumption values can account for many of the daily choices that consumers make. As such, this thesis provides important implications for policy makers and retailers who can use product popularity in campaigns or interventions that aim to stimulate consumer well-being.

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About the author

Robert Pieter Gijsbertus Goedegebure was born in Nieuwdorp (Zeeland) on October 29, 1987. Over the years he received a Bachelor's degree (BBA) in Business Administration from the HZ University of Applied Sciences, a Masters' degree (MSc) in Marketing from the VU Amsterdam, and a Master's degree (MSc) in Consumer Studies from Wageningen University. In 2014 he started his PhD training at the Marketing and Consumer Behaviour Group at Wageningen University. In his research he used a mixture of research methodologies to study the role of social influences in consumer decision making. These studies resulted in the current PhD thesis. During his PhD training Robert was selected as research fellow for the Summer Institute on Bounded Rationality at the Max Planck Institute for Human Development in Berlin (2015). In 2016 he was recognized as Outstanding Reviewer for the scientific journal Appetite. Robert presented his work at multiple renowned international conferences and has (co-) authored several research papers. On a more personal level; Robert enjoys cycling, reading, cooking, punk rock, watching movies and is always on the lookout to taste and evaluate new beers.

Robert Pieter Gijsbertus Goedegebure
Wageningen School of Social Sciences (WASS)
Completed Training and Supervision Plan

Name of the learning activity	Department/Institute	Year	ECTS*
A) Project related competences			
Research Methods: from topic to proposal	WASS	2014	4
PhD Research Proposal	MCB / WASS	2014	4
EDEN doctoral seminar Consumer Research	EIASM	2014	4
Behavioural & Experimental Economics, ECH51306	WUR	2014	6
Summer Institute on Bounded Rationality	Max Planck, Berlin	2015	4
Donders (f)MRI Tool-Kit	Donders Centre for Cognitive Neuroimaging, Nijmegen	2017	2
B) General research related competences			
PhD series: Consumer behaviour	MCB	2014–2016	2
Introduction course	WASS	2014	1
Scientific writing	WGS	2015	1.8
Presenting with Impact	WGS	2015	1
Masterclass Psychology of health & pro-environmental behaviour	WASS	2014–2015	1
WGS Workshop Carousel	WGS	2016	0.3
'Social proof in context: inferential mechanisms & value perception'	WASS PhD Day, WASS	2015	1
'Popularity, Uncertainty, and Societal Value: Extending Naive Theories of Popularity'	SCP @ APA, Denver, USA	2016	1

'The Reasons for Choosing Popular: Extending Naive Theories of Popularity with Uncertainty Reduction and Societal Value'	ACR Latin America, Cali, Colombia	2017	1
'Popularity & Certainty: Extending Naive Theories of Popularity with Uncertainty Reduction'	ACR North America, San Diego, USA	2017	1
'The Subjective Value of Popularity'	ACR North America, Dallas, USA	2018	1
C) Career related competences/personal development			
Supervising thesis students	MCB	2014–2018	2
Teaching assistant	MCB	2014–2018	2
Total			40.1

*One credit according to ECTS is on average equivalent to 28 hours of study load

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