The Customizing Consumer

Shedding Light on Personality- and Context-Related Factors that Influence Consumers’ Decision Making

D I S S E R T A T I O N
of the University of St. Gallen,
School of Management,
Economics, Law, Social Sciences,
and International Affairs
to obtain the title of
Doctor of Philosophy in Management

submitted by

Emanuel de Bellis

from

Basel (Basel-Stadt)

Approved on the application of

Prof. Dr. Andreas Herrmann

and

Prof. Dr. Torsten Tomczak

Dissertation no. 4397

Rosch-Buch, Schesslitz
The University of St. Gallen, School of Management, Economics, Law, Social Sciences and
International Affairs hereby consents to the printing of the present dissertation, without
hereby expressing any opinion on the views herein expressed.

St. Gallen, May 19, 2015

The President:

Prof. Dr. Thomas Bieger
To my dear parents

Maja and Gianfranco de Bellis
Acknowledgments

The completion of this dissertation would not have been possible without a great deal of people. First, I would like to express my gratitude to my doctoral advisor, Prof. Dr. Andreas Herrmann, for the inspiring guidance, his trust and confidence in my work, and the freedom he granted me in developing my own ideas. Further, I thank my co-advisor, Prof. Dr. Torsten Tomczak, for helpful comments on my doctoral proposal and for providing exceptional working conditions at the Center for Customer Insight (CCI).

In view of the range of projects that are being completed in collaboration, I am truly indebted to my co-authors from around the world, amongst others: Dr. Jill Griffin, Prof. Dr. Gerald Häubl, Prof. Dr. Ralph Hertwig, Prof. Dr. Kenichi Ito, Prof. Dr. Bernd Schmitt, and Prof. Dr. David Sprott. A special thank you goes to Dr. Christian Hildebrand and Dr. Michael Schulte-Mecklenbeck for the countless meetings and calls we had and for allowing me to learn so much from them, both professionally and personally.

Further, I am grateful to have received the opportunity to advance part of this dissertation as Visiting Scholar at the University of British Columbia. I feel indebted to my supervisors, Prof. Dr. Joey Hoegg and Prof. Dr. Darren Dahl, for the warm welcome to their team, for allowing me to access their resources, and for the many constructive meetings and fun events. I also thank Thomas Allard, Chuck Howard, Dr. Kirk Kristofferson, and the whole Marketing Division for the good time I had in Vancouver.

The CCI team played a key role in the successful completion of my dissertation. Specifically, I thank Dr. Suleiman Aryobsei, Dr. Lucas Beck, and Dr. Tobias Schlager for being the greatest and most supportive mates I could hope for. Also, I would like to thank Dr. Isabelle Engeler, Dr. des. Christian Hauner, Prof. Dr. Wibke Heidig, Prof. Dr. Reto Hofstetter, Jessica Müller-Stewens, Dr. Christian Purucker, Dr. Philipp Scharfenberger, Dr. Miriam van Tilburg, and Dr. des. Anna Zakharova for creating a pleasant working environment during my time as a PhD student. A big thank you goes to Veronika Hauser, Arlette Niedermann, and Klaus Edel for their important work behind the scenes.

Finally, I feel extremely lucky to be able to count on my dear family. Thank you Maja de Bellis, Gianfranco de Bellis, Andreas Leisinger, and Natascha Bout for your love, your support, and your guidance in helping me get to where I am today. In this context, I would also like to thank my friends from Basel for the fun times we had when I needed a change of
scene from the academic world. Last but not least, I would like to express my sincere gratitude to my fiancée Anna-Louise McCaskey. Thank you Anna for the great and continuing support during this academic journey, for joining me during my year in Canada, and for being the best mother and prospective wife one could imagine. I look forward to our future as a young family together with our son Livio.

St. Gallen, July 2015

Emanuel de Bellis
# Table of Contents

A. Summary / Zusammenfassung .................................................................................... III

B. Article I ............................................................................................................................. 1

C. Article II ......................................................................................................................... 41

D. Article III ....................................................................................................................... 58

E. Article IV ........................................................................................................................ 77

F. Article V ........................................................................................................................ 96

G. Curriculum Vitae ........................................................................................................ 117
Summary

The marketing discipline has largely focused on the investigation of universally applicable principles. This focus is expressed, amongst others, by the oft-quoted marketing mix. Therein, the end consumer merely plays a subordinate role, although it is known nowadays that consumers respond heterogeneously to marketing activities while social media and “big data” provide numerous customer segmentation methods. The present dissertation aims to evaluate and quantify the importance of the individual consumer as well as his or her cultural and environmental decision context. To do so, the author draws on established psychological concepts, which are tested by means of behavioral experiments and secondary field data.

The object of study is mass customization systems, which allow customers to create their own customized products via web-based configurators. Such interfaces are relevant not only because of their manifold potential and their increasing usage around the world, but also because of the central role that is assigned to the consumer during the configuration process. Converging evidence from seven empirical studies shows that individual personality traits considerably affect behavior in configurators. Specifically, narcissism and associated feelings of superiority lead consumers to configure more unique products, while the priming of a narcissistic state allows firms to direct the uniqueness degree of consumer decisions (see Article I).

Besides individual differences, myriad context-related factors influence consumers’ decision making. A series of cross-cultural studies demonstrate that conventional choice architectures do not fit the holistic style of information processing of Eastern cultures, which reduces mental simulation of product use along with consumers’ satisfaction with the configured product (see Article II). Field data of a car manufacturer indicate that local cultural differences must not be neglected either. The inherent uncertainty avoidance of Japanese (vs. Chinese) consumers, for instance, leads to prolonged configuration time spans, which in turn increases the likelihood of a non-purchase (see Article III). These and other empirical findings are summarized and integrated into a conceptual model of mass customization (see Article IV).

The final article deals with an environmental context factor that can fatally influence human decision making. The analysis of over one million car movements shows that drivers—counter to the principles of road safety—tend to exceed speed limits more often
when light conditions are impaired. This finding emphasizes that individuals do not always behave rationally and that the environment in which a decision is made can change the outcome considerably. Taking these influencing factors into consideration enables firms as well as policy makers to improve the impact and scope of their actions and to better meet the manifold needs of consumers.
Zusammenfassung


Article I


This research has been presented at the 2013 Association for Consumer Research (ACR) and the 2015 European Marketing Academy (EMAC).
The Mass-Customizing Shopper: How Narcissism Drives Consumers to Configure Unique Products

Emanuel de Bellis\textsuperscript{a}
David E. Sprott\textsuperscript{b}
Andreas Herrmann\textsuperscript{a}
Hans-Werner Bierhoff\textsuperscript{c}
Elke Rohmann\textsuperscript{c}

\textsuperscript{a}Center for Customer Insight, University of St. Gallen, Switzerland
\textsuperscript{b}Carson College of Business, Washington State University, USA
\textsuperscript{c}Faculty of Psychology, Ruhr University Bochum, Germany
Abstract

Mass customization systems allow retailers and manufacturers to augment product offerings while providing consumers with the opportunity to create unique, self-designed products. Yet field evidence suggests that only a minority of shoppers use the full potential of such systems by configuring products with unique options (e.g., configuring a volcano red car instead of a black one). The segment of those choosing unique product options is of considerable interest to firms given their potential impact on product diffusion and profit margins. The present research finds that heterogeneity of selected product options in a mass customization system is driven by narcissism. In a field study and six additional studies, we demonstrate that narcissistic shoppers configure more unique products while responding strongly to the provision of uniqueness information. In doing so, we show that firms can prime state narcissism to influence the uniqueness of product configurations. Feelings of superiority mediate the narcissism-uniqueness relationship and serve as a boundary condition of narcissists’ proclivity for unique products. Our findings suggest that retailers and manufacturers should consider customers’ narcissistic tendencies, as well as their current states of mind, when integrating mass customization systems into multi-channel distribution strategies.
Main Body

Back in 1918, at the advent of mass production, half of the licensed cars in the United States were Model Ts, most of which looked identical thanks to Henry Ford’s supposed principle that “any customer can have a car painted any color that he wants so long as it is black” (Eliason 2012; Ford 1922, p. 72). Today, given firms’ ability to offer mass-customized products, the picture has radically changed with near limitless options being available via web-based product configurators. These mass customization (MC) systems are provided by retailers and manufacturers (see www.configurator-database.com) and allow consumers to self-design their own products. In the light of firms’ growing interest in multi-channel strategies (e.g., Wallace, Giese, and Johnson 2004), MC systems can also be used to create and make use of new distribution channels. The popularity of these systems in today’s marketplace is supported by findings of a short survey. Asking a sample of US consumers ($N = 102$) how likely they were to customize 12 daily consumer products or services reveals high approval rates for MC systems, from 33% for jewelry and 56% for foods, up to 66% for cars and 80% for vacation packages.

Mass customization systems allow consumers to differentiate themselves from others by communicating their own identity by means of self-designed, unique products (Berger and Heath 2007; Franke and Schreier 2008). Shopper data, however, indicate that only a small portion of consumers uses the full potential of these systems to configure truly unique products. For example, while 74% of car buyers (of a European flagship car model in 2012) chose one of five exterior colors (silver, grey, white, and two shades of black), the remaining 26% of customers picked one out of more than 90 additional colors. Whether it be color, rims, or interior features, it appears that a considerable number of consumers deliberately select product options that do not fit the mainstream, and in fact significantly deviate from it. This market segment is of considerable economic importance to firms, since these consumers provide visibility to the firm’s full range of product options, which in turn speeds up product diffusion and shapes the brand’s image. In addition, uncommon product options are often more expensive (and therefore likely more profitable) than standard ones. For instance, the three most often chosen exterior colors (for the previously referenced flagship car model) had an average surcharge of €317, whereas the three least chosen colors were priced at €2660, on average. While manufacturing costs may be higher for unique product options, profit margins are still substantially larger for those options.
Who are the consumers who select unique options when using MC systems and what motivates them to self-design products in such a way? Conceptual research suggests that answers to these questions may reside within the narcissistic personality construct (Sedikides et al. 2007), defined as an unjustified conceit implying an excessive motive to self-enhance (Lee, Gregg, and Park 2013; see Study 1 for a more detailed definition). Initial support for the notion that narcissistic consumers are prone to use MC systems is provided by the earlier referenced survey, which reveals a positive relationship between consumers’ narcissistic tendencies and their likelihood to customize products ($\beta = .20, t(100) = 2.02, p < .05$). Our general premise is that some consumers design unique products as an expression of their narcissistic tendencies or due to a temporary narcissistic state of mind. We argue that the configuration and consumption of unique products serve as an important strategy for narcissists to appear unique in the material world (Emmons 1984), to be perceived as superior and to self-enhance (Sedikides et al. 2007), and to project a colorful lifestyle to the public (Chatterjee and Hambrick 2007). These issues are particularly relevant today, as cross-sectional studies show that consumer narcissism has increased by 30% since the 1980s and is likely to continue to expand along with the rise of social media (Twenge et al. 2008).

To date, no empirical research has examined the nature of shoppers who make use of the full individualization potential of MC systems. The present work addresses this gap by exploring the impact of consumers’ narcissistic tendencies and states of mind in an MC context and showing how these mechanisms can be used to influence the uniqueness of configured products. As such, the findings of this research have important implications for the design of MC systems, customer segmentation, and marketing communication strategies associated with the use of such systems by retailers and manufacturers.

**Theoretical Background and Hypotheses**

Mass customization, derived from the combination of the two apparently contradictory terms “mass production” and “customization,” is an integral part of the multi-channel distribution strategy that is beneficial to both retailing and manufacturing firms (Huffman and Kahn 1998; Wallace et al. 2004). Given the distinct opportunity to create and showcase unique products, MC systems are a particularly promising environment for narcissists. The accumulated literature demonstrates that enabling consumers to express their individual preferences by using web-based product configurators (i.e., software applications that facilitate the MC of products) can decrease choice complexity and increase customer
satisfaction, while leading to greater purchase likelihood and higher willingness to pay (Broniarczyk and Griffin 2014; Franke, Schreier, and Kaiser 2010; Moreau, Bonney, and Herd 2011; Valenzuela, Dhar, and Zettelmeyer 2009). At the same time, researchers have begun exploring the boundary conditions (e.g., Coker and Nagpal 2013; de Bellis et al. in press) as well as the underlying processes for these effects. Firms offering MC systems not only benefit from increased preference fit and design effort, but also from instilling feelings of being the creator of a product design, which in turn enhances consumers’ pride and feelings of accomplishment. These “I designed it myself” (Franke et al. 2010) or “I made it myself” (Troye and Supphellen 2012) effects represent how MC systems enable consumers to create individualized products that express uniqueness.

Narcissists are characterized by a desire for self-aggrandizement and self-enhancement, with agentic self-beliefs (e.g., dominance, uniqueness, status, and autonomy) standing at the center of their self-identity (Campbell and Foster 2007; Emmons 1984; Sedikides et al. 2007). Whereas in Western cultures most people desire to differ from others in order to establish their personal identity (Snyder and Fromkin 1980), recent research has shown that the need for uniqueness is especially strong for the narcissist (Lee et al. 2013).¹ According to the agency model of narcissism, narcissists emphasize agentic traits that fuel narcissistic interpersonal strategies, such as an aspiration toward uniqueness (Campbell and Foster 2007). Therefore, narcissists explicitly strive for uniqueness as a means of self-enhancement (Sedikides et al. 2007). As consumers, narcissists should seek opportunities to confirm or enhance their self-image, with related consumption decisions being closely linked to agentic self-beliefs. Thus, narcissistic consumers are likely to focus their attention on products with higher prestige and stylish exclusivity, therefore constituting an important market segment that identifies with the latest, in-fashion products (Sedikides, Cisek, and Hart 2011).

Narcissistic consumers should be particularly prone to the self-signaling function of mass-customized products because of their self-centered bias (Dhar and Wertenbroch 2012) and their inclination to “favor the extreme, the grandiose, and the colorful,” while “discreet or incremental actions are not satisfying” (Chatterjee and Hambrick 2007, p. 355). These views suggest that narcissistic shoppers believe they can overcome the “average” and acknowledge the “special” by configuring products which incorporate unique features. Moreover,

¹ The need for uniqueness construct is not equivalent to narcissism. Whereas narcissism is defined as a pattern of grandiosity which is combined with need for admiration and lack of empathy, need for uniqueness refers to the desire to possess extraordinary characteristics.
customizing and consuming unique products involves social risk because the choice is not supported by a substantial number of other consumers. Given that narcissism has been shown to be consistently related to enhanced risk taking (Foster, Shenesey, and Goff 2009), narcissistic consumers should be less concerned about the risks associated with customizing and consuming a unique product. Finally, while initial empirical evidence indicates that narcissism is positively associated with compulsive buying (Rose 2007), more recent research highlights that narcissists’ inherent desire to distinguish themselves from others is also reflected in their regular consumption behavior (e.g., by a greater interest in scarce, exclusive, and personalizable products; Lee et al. 2013; Lee and Seidle 2012). In sum, because of narcissists’ agentic self-beliefs, their enhanced need for uniqueness, and their risk-taking nature, narcissistic consumers are likely to show a proclivity for self-designing unique products. More formally, we hypothesize:

**H1.** Greater narcissistic tendencies of a shopper lead to the choice of more unique product options and thus to increased product uniqueness when using MC systems.

While narcissism has been predominantly studied as a trait exhibiting stability over time (Raskin and Hall 1981), more recent work suggests that situational variations in narcissism can manifest as well (Sakellaropoulo and Baldwin 2007). Similar to the comparison of trait and state self-esteem, trait and state narcissism refer to stable cross-situational consistency versus situation-specific elicitation of a concept, respectively. Building on this nascent stream of research, we propose that priming narcissism as a state of mind will lead to similar effects on product uniqueness as does its trait counterpart (H1). Inducing a narcissistic state of mind (independent of consumers’ predominant levels of trait narcissism) provides support for the proposed causal effect of narcissism on product uniqueness. In addition, developing a priming technique that is simple to apply in marketing practice provides firms and policy makers with a strategic tool to direct the uniqueness of configured products. Given the preceding, we propose:

**H2.** Priming a narcissistic (vs. non-narcissistic) state of mind increases product uniqueness.

Firms can design MC systems to make the most of the narcissist’s agentic self-beliefs by providing uniqueness information about the customized product at the end of the configuration process. Such feedback would prove beneficial to narcissistic consumers, especially when using complex MC systems where the likelihood of configuring a truly
unique product is high (e.g., some car configurators allow for millions of product option combinations). Because narcissists attach considerable importance to the creation of unique products (H1), their product evaluations are likely to be strongly affected by such feedback. In particular, we propose that narcissistic consumers will exhibit greater feelings of accomplishment (cf. Franke et al. 2010) and greater satisfaction with the customized product (cf. Hildebrand et al. 2013) when feedback confirms their configuration as unique. In contrast, feedback implying the configured product is not unique (or standard) will disconfirm the uniqueness claim of narcissists and disappoint them because such feedback is at odds with their self-identity. We hypothesize:

**H3a.** The effect of feedback regarding the uniqueness of a configured product on product evaluations is moderated by shoppers’ narcissistic tendencies.

Current MC systems not only enable firms to indicate the uniqueness of the final, configured product, but also allow for the provision of uniqueness information during the configuration process. Narcissistic shoppers should be keen to learn whether a given product option has been chosen frequently or rarely in the past. By providing information about the uniqueness of products options—for instance, specifying the percentage share of the exterior color “volcano red” as 2% and “silver” as 23% (relative to all other exterior colors)—consumers can opt for their preferred level of uniqueness while configuring. Given narcissists’ desire to create a truly unique product, their choice should be strongly influenced by such information, with narcissistic consumers adjusting their choice of options based on the percentage share of product options. Providing manipulated percentage shares allows one to examine whether narcissists put more emphasis on choosing unique options (and therefore creating a unique product) than on their personal preferences. Thus, we propose:

**H3b.** Greater narcissistic tendencies of a shopper lead to the choice of product options with lower (vs. higher) manipulated percentage share.

Consumers’ feelings of superiority are proposed to mediate the narcissism-uniqueness link (H1), since they are triggered by narcissistic beliefs and are considered as an underlying motive of narcissists (Emmons 1987; Sedikides et al. 2007). Feelings of superiority are likely to make a person focus on the self-enhancing consequences of one’s choices. Not surprisingly, firms often use superiority claims when making comparisons to competitive offerings (e.g., “You won’t even need to speed past other drivers to make them feel inferior,” a slogan used by Bentley in 2010). While people in general consider themselves to be better
than the average (Kruger and Dunning 1999), narcissists emphasize this tendency more so than others (Campbell, Rudich, and Sedikides 2002). Narcissists’ preoccupation with prestige and entitlement can be achieved by uncommon brands and designs, something which (according to narcissists) is better than what the average consumer deserves. This motive should emerge in situations allowing for superior self-presentation (Krizan and Bushman 2011), such as when self-designing and purchasing products with MC systems. For narcissists, creating a truly unique product is an opportunity to confirm and fulfill their superiority claim. As such, we hypothesize:

**H4.** The positive relationship between narcissism and product uniqueness is mediated by shoppers’ feelings of superiority.

We finally explore how influencing consumers’ feelings of superiority will serve as a boundary condition for the proposed narcissism-uniqueness relationship, providing additional evidence for the mediating role of superiority feelings (i.e., by testing a mediational process through a moderating variable; Spencer, Zanna, and Fong 2005). Building on H4, we aim to shut off the effect of narcissism on product uniqueness by diminishing feelings of superiority via a mental simulation task. Providing consumers with equal (vs. superior) performance feedback should make superiority-related cognitions less available in memory through spreading activation processes (Berger and Fitzsimons 2008), prompting narcissists to temporarily feel less superior. In so doing, we predict that diminishing narcissists’ inherent feelings of superiority will reduce the uniqueness-enhancing consequences of narcissism in the context of MC systems. Thus, we hypothesize:

**H5.** Inducing feelings of equality eliminates the positive relationship between narcissism and product uniqueness.

To test these focal hypotheses, we report the results of a field study and six additional studies within the context of MC. We focus on two customizable product categories: automobiles (due to the integration of MC systems into the automotive industry’s distribution system) and foods (to extend our findings to a non-durable product category; see also Nagpal, Lei, and Khare in press). The present research concludes with a discussion of why and how

---

2 Per the initially referenced survey, consumers’ willingness to customize these two products is above average (66% for cars and 56% for foods), but their appeal to narcissists differs; while narcissistic consumers are particularly willing to customize cars, the amount of narcissists and non-narcissists is about equal when it comes to the configuration of foods, thereby serving as a conservative test of our hypotheses.
retailers should consider narcissistic customers, as well as their associated states of mind, when implementing MC systems.

**Study 1: Field Evidence for Narcissists’ Desire for Uniquely Configured Products**

Study 1 examines whether variations in consumer narcissism influence product uniqueness (H1). To test this basic premise in a natural environment, we questioned recent car buyers and analyzed their purchased automobile along with their narcissistic tendencies.

**Method**

*Narcissism measure.* The focal independent variable for Studies 1 and 3 to 5 is the 15-item short form of the Narcissistic Personality Inventory (NPI-15; Schütz, Marcus, and Sellin 2004), a validated measure of narcissism that has been used in numerous previous studies (e.g., Hepper, Gramzow, and Sedikides 2010). The NPI-15 assesses relevant deviations from the normal range of self-esteem and is based on Raskin and Terry’s (1988) concept of narcissism as a subclinical personality construct (American Psychiatric Association 2013). For the NPI-15, respondents are given 15 pairs of phrases ($\alpha = .67$); one phrase represents a narcissistic response (e.g., “I am going to be a great person”) and the other a non-narcissistic response (e.g., “I hope I am going to be successful”; see Appendix). For each pair, respondents are requested to select the response closest to their own beliefs. The number of narcissistic responses are summed to form a narcissism score ranging from 0 (not at all narcissistic) to 15 (very narcissistic). Analyses were carried out on a continuous measure of narcissism (cf. Foster and Campbell 2007).

*Uniqueness index.* To examine the uniqueness of the customized automobile, we assessed (1) car buyers’ subjective uniqueness perception as well as (2) an objective uniqueness index. The former was based on customers’ uniqueness estimation of six essential car attributes (e.g., “How many other customers have chosen the same sound system?” gauged on seven-point scales with 1 = “very few,” and 7 = “many,” averaged to form a single indicator and recoded to represent a measure of uniqueness; $\alpha = .77$). To quantify product uniqueness, we created a uniqueness index ($UI$), that is, an objective measure of uniqueness based on percentage shares of the selected product options (data obtained from the car manufacturer). For each of the six chosen options, actual percentage share data were placed in context against the number of options for a particular attribute via the following equation:
where $i$ represents the attributes (exterior color, rims, seat upholstery, decorative elements, steering wheel, and sound system), $PS$ refers to the percentage share of the chosen option of the $i^{th}$ attribute, $O$ refers to the number of options for the $i^{th}$ attribute, and $A$ refers to the number of attributes. A higher $UI$ represents a more unique configured product, since relatively unique options with lower percentage shares have a greater weighting than relatively common options that possess higher shares. In Study 1, the $UI$ ranged from $-.39$ to $.57$ ($M_{UI} = .11$).

Procedure. Recent car buyers were recruited and compensated for participation by a commercial market research company. Participants were selected from a database that included customers who were confirmed to have purchased or leased a new car of a specific brand in Germany within the last two years. Customers were only included in analyses if they confirmed (at the end of the survey) that the car configured in the study corresponded to the car they had actually purchased. The sample size consisted of 34 recent car buyers (44% female; $M_{age} = 40$). Data were collected via a short online survey that asked a variety of questions about the car purchase. Customers began by completing standardized scales: the NPI-15 as an indication of car buyers’ narcissistic tendencies, the 10-item Rosenberg Self-Esteem Scale (Rosenberg 1965) as a measure of self-esteem, as well as the 4-item Knowledge of Product Class Scale (Chang 2004) gauging general car expertise. Next, customers were asked to configure their recently purchased car by means of the original car configurator of the manufacturer and to provide us with their configuration code (i.e., a unique tracking code tied to a configuration and changes thereof), allowing us to examine customers’ chosen car attributes as well as their price surcharges. The survey concluded with the measurement of car buyers’ subjective uniqueness perception of the six car attributes, along with demographics and a debriefing.

Pretest

We conducted a pretest to determine consumers’ ability to judge uniqueness of product options in an MC system. Percentage share of an option serves as a reasonable indicator of uniqueness as it represents the choice frequency of a particular option for a given attribute (e.g., 23% of customers have chosen “silver” as the exterior color). A sample of MBA students ($N = 27$) was recruited for a paper-and-pencil study, who ranked options of
each attribute (appearing in a mock-up car configurator) according to expected percentage shares. Participants’ rankings were then compared with the actual percentage share figures obtained from the manufacturer. Estimated and real rankings were highly correlated for all attributes (exterior color: $r = .82$, $p < .01$; rims: $r = .95$, $p < .001$; seat upholstery: $r = .85$, $p < .01$; decorative elements: $r = .86$, $p < .05$; steering wheel: $r = .83$, $p < .05$; sound system: $r = 1.00$, $p < .001$). Based on this pretest, consumers are remarkably accurate in estimating which options are selected most often in real automotive markets and which ones are unique.

Results and Discussion

Supporting our uniqueness expectations for narcissistic shoppers and based on the objective uniqueness index, we found that consumer narcissism is positively related to product uniqueness ($\beta = .51$, $t(32) = 3.32$, $p < .01$). When including self-esteem into the regression model, narcissism remained a strong predictor of the uniqueness index ($\beta = .47$, $t(31) = 3.09$, $p < .01$), while self-esteem was not ($\beta = -.21$, $t(31) = -1.34$, $p > .18$). The effect also persisted when controlling for customers’ age ($\beta = .43$, $t(31) = 2.63$, $p < .05$), income ($\beta = .50$, $t(31) = 3.29$, $p < .01$), as well as car expertise ($\beta = .49$, $t(31) = 3.21$, $p < .01$), thereby providing robust support for H1. Having asked car buyers about their subjective uniqueness perceptions provided directional support that narcissists also estimated their chosen car attributes as more unique ($\beta = .29$, $t(32) = 1.73$, $p = .09$).

Given that the product configured in the study matched the car they actually purchased with their own funds, customers were aware of the price surcharges associated with chosen product options, as well as the total cost price. In the light of unique products oftentimes being more expensive than common ones, narcissists also paid a marginally higher price for their cars ($\beta = .30$, $t(32) = 1.80$, $p = .08$). Classifying recent car buyers along the narcissism continuum (with narcissists specified as those in the upper third and non-narcissists in the lower third of the narcissism score; Lee and Seidle 2012) demonstrates the magnitude of these effects: While non-narcissists on average spent €40,515 for their new vehicle, narcissists paid €63,208 or over 50% more ($t(20) = 2.03$, $p < .05$). Overall, findings from the field study showed that actual customers scoring high on narcissism self-designed more unique and more expensive products. We next turn our attention to approaches able to create a narcissistic state of mind among consumers.
Study 2a: Priming a Narcissistic State of Mind

The aim of Study 2a is to present causal evidence that narcissism (and not other, related constructs) drives product uniqueness by demonstrating that the effects of narcissism can be induced temporarily through a state-based approach (H2). To complement Study 1’s field setting, we conducted this study in a controlled environment using a mock-up car configurator.

Method

Mock-up car configurator. Configurators for automobiles offer a range of attributes (e.g., seat upholstery) and options (e.g., leather with embossing), many of which can be combined according to one’s own preferences. For the purpose of this research, we rebuilt the online configurator of a large European car manufacturer. The MC system consisted of six important car attributes (each with several options, as indicated in parentheses): exterior color (12), rims (9), seat upholstery (8), decorative elements (6), steering wheel (6), and sound system (3). The number of possible option combinations are vast (over 90,000 combinations exist in our simplified configurator), thereby allowing consumers to configure a truly unique vehicle. To obtain an unaffected indication of preferences, we did not include the price of the presented product options in this study.

Variables. To induce a narcissistic state, we adapted the priming technique developed by Sakellaropoulos and Baldwin (2007). In a visualization task, consumers in the “narcissism activation” condition were asked to “describe a specific and personally experienced occasion in which you felt you had impressed someone.” In the “acceptance activation” condition, consumers were instructed to “describe a specific and personally experienced occasion in which you felt you were socially accepted and/or included.” The latter approach allowed consumers to reflect upon a socially positive experience, but without narcissistic elements associated with the narcissism visualization. In both conditions, consumers could take as much time as they needed (at least three minutes) to describe the requested memory. Following, they were asked to “focus in on the memory and get it as clear as possible” and to hold the image and accompanying feelings in mind. The dependent variable was the uniqueness index ($UI$ per the equation), which was computed on the basis of respondents’ configured car in the mock-up configurator.

Procedure. One-hundred and fifty-five participants who regularly used a car were recruited through Amazon Mechanical Turk (MTurk) and were randomly assigned to
experimental conditions. Twenty-seven respondents who failed an instructional manipulation check were excluded, resulting in a final sample of 128 participants (57% female; $M_{\text{age}} = 36$), of which 63 were in the narcissism activation condition and 65 in the acceptance activation condition. Participants were told that the study would consist of two unrelated parts, a visualization task and a car configuration task. They were introduced to the respective version of the visualization task before creating their preferred car using the mock-up configurator. To do so, they passed through the configurator in a fixed order and chose one option per attribute (similar to the manufacturer’s real online MC system). The study ended by completion of final questions, demographics, and a debriefing.

Pretest

A pretest was conducted to ensure that the priming technique increased state narcissism without affecting related constructs. Employing the same exclusion criteria as previously noted, the final pretest sample included 112 respondents recruited through MTurk. To gauge state narcissism, we used a 7-item measure adapted from Sakellaropoulo and Baldwin (2007). This scale was developed by taking the highest loading item from each of seven first-order principal components of the NPI-40 trait measure (Raskin and Terry 1988), with an eye toward items that could be reworded to a state form (e.g., “Right now, I feel I am an exceptional person”; $\alpha = .82$). Similarly, we collected a 7-item state version of the Rosenberg Self-Esteem Scale (Rosenberg 1965; $\alpha = .77$) and the 20-item Positive and Negative Affect Scale (PANAS; Watson, Clark, and Tellegen 1988; $\alpha = .88$) as a measure of current mood. Analyses revealed that the narcissism (vs. acceptance) priming increased state narcissism ($M_{\text{narcissism}} = 28.47, M_{\text{acceptance}} = 24.85; t(110) = 2.36, p < .01$), but did not affect state self-esteem ($p > .21$), positive affect ($p > .68$), nor negative affect ($p > .75$).

Results and Discussion

Besides encouraging state narcissism (without affecting other focal constructs, per the pretest), we found that the narcissism priming also affected the uniqueness of shoppers’ configured cars. In support of H2, analyses determined that priming a narcissistic (vs. non-narcissistic) state of mind significantly increased product uniqueness ($M_{\text{narcissism}} = .14, M_{\text{acceptance}} = .04; t(126) = 2.46, p < .01$). These findings provide causal evidence of the relationship between narcissism and product uniqueness in MC decisions and suggest that practitioners have the ability to affect the uniqueness of configured products along with consumers’ narcissistic states of mind (an issue we turn to in more detail next).
Study 2b: Making of the Narcissist in Marketing Practice

In the previous study, we showed that priming a narcissistic state of mind resulted in augmented product uniqueness. In Study 2b, we build upon the conceptual core of Study 2a, while employing a more market applicable priming technique. In so doing, we aim to broaden the scope of our findings by providing marketers with a strategic tool to influence consumer narcissism along with its distinct effects on product uniqueness.

Method

Variables. To generate a narcissistic state of mind, we employed an existing automobile advertisement that displayed a car driving in a natural scene (the same car model as used in the mock-up car configurator). For the experiment, we added a slogan that was placed prominently in the top-left corner of the ad and varied between experimental conditions (see Fig. 1), with effects expected similar to a lexical decision task (cf. Sakellaropoulo and Baldwin 2007). In the “narcissism activation” condition, the slogan read “You impress. Like the new Audi A6,” while in the “acceptance activation” condition it was “You belong. Like the new Audi A6.” Consumers were requested to “look carefully at the image and the slogan of the advertisement and visualize the scene” and to write down “thoughts and feelings about the scene.” The uniqueness index ($UI$ per the equation) represented the dependent variable for this study.

--- Insert Fig. 1 here ---

Procedure. Eighty-seven participants who regularly used a car were recruited through MTurk and were randomly assigned to experimental conditions. A total of 14 respondents who failed an instructional manipulation check were excluded, resulting in a final sample of 73 participants (43% female; $M_{age} = 34$), of which 36 participants were in the narcissism activation condition and 37 in the acceptance activation condition. The study consisted of two parts; the advertisement evaluation task (which included the experimental manipulation and lasted for two minutes) and the configuration of one’s preferred car via the mock-up car configurator. Final questions, demographics, and a debriefing concluded the study.

Pretest

To ensure the ad-based priming technique increased state narcissism without affecting related constructs, we employed a pretest ($N = 62$) conducted through MTurk. As in the pretest of Study 2a, we presented respondents with the experimental conditions and measured
state narcissism ($\alpha = .89$), state self-esteem ($\alpha = .76$), and current mood ($\alpha = .89$). Results revealed that the narcissism (vs. acceptance) priming significantly increased state narcissism ($M_{narcissim} = 29.30$, $M_{acceptance} = 23.72$; $t(60) = 2.41$, $p < .01$), but did not affect state self-esteem ($p > .14$), positive affect ($p > .22$), nor negative affect ($p > .11$).

Results and Discussion

While the ad-based priming increased state narcissism in the pretest, it also affected the uniqueness of consumers’ configured cars. In particular, priming a narcissistic (vs. non-narcissistic) state of mind significantly increased objective product uniqueness ($M_{narcissim} = .10$, $M_{acceptance} = −.03$; $t(71) = 2.20$, $p < .05$), providing additional support for H2. This finding suggests an efficient tool for marketers to influence the uniqueness of configured products. Thus far, we have established that trait narcissism (Study 1) and state narcissism (Studies 2a and 2b) lead to the self-design of more unique products when using an MC system. Next, we explore how narcissistic consumers respond to the provision of uniqueness information about the configured product.

Study 3a: Narcissists’ Response to Product Uniqueness Feedback

Mass customization systems seem to be a particularly promising environment to accentuate the agentic self-beliefs of narcissistic shoppers. This study examines how product uniqueness feedback affects product evaluations of consumers who vary in their levels of narcissism (H3a) while providing an additional test for H1.

Method

Variables. As in Study 1, consumers completed the NPI-15 as a measure of narcissism ($\alpha = .80$). After configuring their preferred car, consumers received feedback on the uniqueness of their configuration. The feedback was introduced as follows: “The Audi A6 you have configured is now being compared against the manufacturer’s database. This database contains all 36,596 Audi A6 vehicles that have been configured in Germany during this year. After the matching, you will receive feedback about how unique or standard your car is compared to the vehicles in the database.” Next, a programmed delay (including a computer-based loading sign with feedback on the supposed process) led consumers to believe their configuration was being compared with the database. Subsequently, consumers were randomly assigned to manipulated feedback. For the “unique feedback” (“non-unique
(feedback”) condition, consumers read: “Comparing your vehicle against the manufacturer’s database produced the following results: Your configured Audi A6 is (not) a unique vehicle for this market. No Audi A6 (Many Audi A6s) delivered in Germany during this year was (were) similar to yours. You have configured a vehicle that is not equivalent (equivalent) to a standard configuration.”

The primary dependent variable was consumers’ perceived feelings of accomplishment about the customized car (three items on seven-point Likert scales, e.g., “I feel proud of having accomplished something”; $\alpha = .94$), a key success driver of current MC systems (Franke et al. 2010). In addition, we assessed consumers’ satisfaction with the customized product (five items on seven-point Likert scales, e.g., “All in all, I am satisfied with my choice of car”; $\alpha = .61$), as a general measure of choice satisfaction (Hildebrand et al. 2013). As in the previous studies, we employed the uniqueness index ($UI$ per the equation) as objective measure of product uniqueness.

**Procedure.** The sample ($N = 109$) included panel members from a commercial research firm who were compensated for participation and randomly assigned to treatment conditions. Participants were only eligible for the study if they regularly used a car. Seventeen consumers who did not perceive the feedback as realistic were excluded from further analyses. Thus, 92 participants (55% female; $M_{\text{age}} = 40$) were included in the main analysis, with a roughly equal distribution between the unique ($n = 49$) and non-unique ($n = 43$) feedback conditions. After agreeing to participate, consumers completed the NPI-15 to assess narcissistic tendencies. Next, participants configured their car using the mock-up configurator, which was followed by the experimental feedback. At the end of the study, but before being debriefed, participants completed evaluative measures of the configured product as well as demographics.

**Results and Discussion**

Consumers’ narcissistic tendencies moderated the effect of uniqueness feedback on product evaluations. Regressing feelings of accomplishment on narcissism, uniqueness feedback (unique feedback = 1, non-unique feedback = 0), and their interaction showed the predicted significant interaction ($\beta = .44$, $t(88) = 2.13$, $p < .05$), while no main effects emerged. We used the Johnson-Neyman technique to identify ranges of narcissism for which the simple effect of uniqueness feedback was significant (cf. Spiller et al. 2013). This “floodlight analysis” revealed a significant positive effect of unique (vs. non-unique) feedback on feelings of accomplishment for anyone with a narcissism score greater than 5.89
(see Fig. 2, Panel a). We obtained similar results for consumers’ satisfaction with the customized product, as indicated by a significant interaction between narcissism and uniqueness feedback ($\beta = .44, t(88) = 2.07, p < .05$). Specifically, there was a significant positive effect of unique (vs. non-unique) feedback on satisfaction for any consumer with a narcissism score greater than 6.71 (see Fig. 2, Panel b). These results both support H3a.

--- Insert Fig. 2 here ---

In line with the field study and H1, we also found narcissism to result in more objectively unique product configurations ($\beta = .29, t(90) = 2.90, p < .01$), providing renewed support for a robust narcissism-uniqueness relationship. This effect remained stable when controlling for consumers’ age ($\beta = .28, t(89) = 2.80, p < .01$), income ($\beta = .29, t(89) = 2.90, p < .01$), and car expertise ($\beta = .27, t(89) = 2.72, p < .01$).

In addition to replicating the findings from the field study, Study 3a demonstrated that narcissistic consumers react strongly to feedback on their final product’s level of uniqueness. When told that their configured product was not unique, narcissists felt less accomplishment and less satisfaction about their self-designed product. These effects on product evaluation appear to be driven by both increases from unique feedback, as well as decreases from non-unique feedback (see Fig. 2). This study’s findings provide further evidence that narcissists attach considerable importance to creating unique products and demonstrate one way firms can use MC systems to increase customers’ evaluations of configured products.

**Study 3b: The Influence of Option Uniqueness Information**

While Study 3a examined the effect of feedback regarding the uniqueness of the final product on consumers’ product evaluations, Study 3b explores the impact of providing uniqueness information about product options on consumers’ choices of those options (H3b).

**Method**

*Variables.* The NPI-15 measure of narcissism ($\alpha = .76$) served as the key independent variable. Within the mock-up car configurator, we presented option uniqueness information as the percentage share (relative to other options) for a particular attribute. Consumers read: “The percentage share of a product option indicates its choice frequency relative to other options. A share of 50% would therefore indicate that many people choose this option (i.e., it corresponds to a standard option), while a share of 1% would indicate that the option is chosen only occasionally.” The percentage share values were randomly assigned to options.
for a particular attribute. For instance, the real percentage share of “alloy wheels 5 segment spokes” is 6%, “alloy wheels 10 spokes” is 13%, and “forged wheels 6 arm” is 23%. In this study, we manipulated these figures by randomly assigning percentages to options of an attribute, so the percentage share of “alloy wheels 5 segment spokes” could have been 13% or 23% (instead of 6%). The primary dependent variable represented whether consumers chose product options with low vs. high (manipulated) percentage shares. This choice variable was measured through the same uniqueness index used in Study 1 (UI per the equation), but using the manipulated percentage shares instead of real ones.

Procedure. Participants (N = 66; 42% female; M_age = 42) included panel members from a commercial research firm who were compensated for participation, and were only eligible if they regularly used a car. Participants began by completing the NPI-15 narcissism measure. After self-designing their preferred car using our mock-up configurator (including manipulated percentage share information), participants completed demographics and were debriefed.

Results and Discussion

Regression analysis showed that narcissism positively influenced the choice of product options with low (manipulated) percentage share (β = .25, t(64) = 2.04, p < .05). These findings provide support for a systematic relation between narcissism and emphasis on a product option’s uniqueness (H3b). Narcissistic consumers shopped for relatively unique options (those with low percentage share) and adjusted their car configuration according to this information, thereby placing product uniqueness over personal preferences. Thus, providing option uniqueness information could be a useful means for firms to guide customers, especially narcissistic ones, in their configuration process.

Study 4: The Mediating Role of Feelings of Superiority

Our empirical studies have shown thus far that consumers’ narcissistic tendencies are an important driver of product uniqueness, that the priming of narcissistic states of mind yields similar outcomes, and that narcissistic consumers significantly respond to provided uniqueness information. We next explore the underlying processes of the narcissism-uniqueness link and test whether this effect is mediated by consumers’ feelings of superiority (H4).
Method

Variables. While the NPI-15 narcissism measure ($\alpha = .80$) served as the primary independent variable, we also collected two possible mediators. Cognitive consequences of consumers’ feelings of superiority were obtained by the Better-Than-Average Self-Construal Scale comprising 9 items (e.g., “Many people suffer from inferiority feelings. I, on the contrary, oftentimes have the feeling of superiority”; Bierhoff 2014; $\alpha = .75$). The scale taps into inflated self-assessments and has been shown to be a reliable and consistent measure of superiority feelings. Given prior research showing that consumers’ need for uniqueness influences customization experiences (cf. Franke and Schreier 2008), we also assessed the Creative Choice Counterconformity subscale of the Consumers’ Need for Uniqueness measure (the subscale includes 11 items, such as “I collect unusual products as a way of telling people I’m different”; Tian, Bearden, and Hunter 2001; $\alpha = .95$). Similar to the previous studies, we computed the uniqueness index ($UI$ per the equation) serving as the primary dependent variable.

Procedure. Participants ($N = 213$; 48% female; $M_{age} = 41$) included panel members from a commercial research firm who regularly used a car and were compensated for participation. Data were collected online via the mock-up car configurator. Participants completed the NPI-15 before configuring their car. Finally, participants responded to the putative mediators (feelings of superiority and need for uniqueness) along with demographics, before being debriefed.

Results and Discussion

Discriminant validity between narcissism, feelings of superiority, and need for uniqueness was examined by comparing the average variance extracted (AVE) values for each pair of constructs with the $\Phi^2$ value between them (cf. Fornell and Larcker 1981). No $\Phi^2$ is greater than the individual AVE values, thereby supporting the discriminant validity of the scales. A scree plot further confirmed unidimensionality of the narcissism scale as indicated by a large drop in eigenvalues from the first (4.04) to the second component (1.39) and a subsequent flattening of the curve (e.g., 1.22 for the third component). The good Cronbach alpha score ($\alpha = .80$) provided further support for the scale’s high internal consistency.

To test underlying processes, we employed a mediation model with bootstrapped estimates (cf. Preacher and Hayes 2008) and included narcissism as the independent variable, feelings of superiority as mediator, and the uniqueness index as the key outcome variable. In
line with our previous studies, the bootstrap test identified a significant total effect of narcissism on product uniqueness \((c = 7.35, p < .05; \text{see Fig. 3})\), providing renewed support for H1. Importantly, the indirect effect of feelings of superiority was positive and significant \((a \times b = 4.71)\), with a 95% confidence interval (CI) excluding zero (1.26 to 8.88). The direct effect of narcissism on product uniqueness was no longer significant after including feelings of superiority into the model \((c' = 2.64, p > .44)\), thereby establishing full mediation and supporting H4. Specifying the same model but controlling for consumers’ need for uniqueness also yielded a significant indirect effect \((a \times b = 3.70, 95\% \text{ CI: .45 to 7.38})\) as well as a full mediation \((c' = 1.13, p > .75)\).

--- Insert Fig. 3 here ---

Study 4 showed that narcissists’ enhanced feelings of superiority underlie the narcissism-uniqueness relationship. These findings suggest that uniquely configured products, and more broadly the use of MC systems, help narcissists to self-enhance as expressed by their sense of superiority.

### Study 5: Boundary Conditions of the Narcissism-Uniqueness Link

By experimentally diminishing consumers’ feelings of superiority in Study 5, we provide further support for the underlying process and reveal a boundary condition for the narcissism-uniqueness link (H5). We focus on a non-durable product (i.e., the emerging customization of foods in retailing; Nagpal et al. in press) in order to assess the generalizability of our findings.

**Method**

*Mock-up food configurator.* Following a US retail chain, we developed a cupcake configurator (“Baked by Anna-Louise”). While the configurator allowed consumers to customize their preferred product as in previous studies, the product category in Study 5 is distinct in a variety of ways, including lower price, shorter product life cycle, and less consumer knowledge about product options. The cupcake configurator enabled consumers to customize four attributes (cake, icing, topping, and stuffing), with each attribute including four options. Given weaker consumer knowledge about product options, we provided consumers with an indication of uniqueness by randomly assigning one of the four options the following sign: “Be the first to taste it. No other customer has chosen this particular option yet today.” Consumers’ understanding of the sign was tested at the end of the study.
Variables. Besides the NPI-15 narcissism measure ($\alpha = .87$), this study included a mental simulation task as a second independent variable. Specifically, we manipulated feelings of superiority by asking consumers to imagine a performance review at work. In the “equality feedback” condition, consumers read that “your performance was on average during the last work period. Indeed, you performed similarly to your colleagues.” In the “superiority feedback” condition, consumers were told that “your performance was above average during the last work period. Indeed, you performed clearly better than your colleagues.” After the treatment, all consumers wrote down three thoughts or feelings related to the performance feedback. As a manipulation check, we measured current feelings of superiority (“How do you feel right now?” with the three items “superior,” “predominant,” and “surpassing” on seven-point Likert scales; $\alpha = .88$). To distinguish superiority from uniqueness, we also included three items measuring current feelings of uniqueness (“unique,” “distinct,” and “unparalleled”; $\alpha = .83$). Compared to the approach used for the more complex car configurator, the primary dependent variable in Study 5 was a simple measure of uniqueness computed as the number of unique product options chosen (containing the “Be the first to taste it” sign) and ranged from 0 to 4 ($M_{\text{uniqueness}} = 1.46$).

Procedure. Ninety-two participants were recruited through MTurk and were randomly assigned to experimental conditions. Fourteen respondents who failed an instructional manipulation check (cf. Goodman, Cryder, and Cheema 2013) were excluded from further analyses, resulting in a final sample of 78 participants (38% female; $M_{\text{age}} = 32$), of which 36 were in the equality feedback condition and 42 in the superiority feedback condition. Participants began the study by completing the mental simulation task comprising the performance feedback. They were then introduced to the cupcake configurator and asked to configure their preferred cupcake by choosing from various options offered over four attributes. The study finished with completion of a manipulation check, final questions, and demographics, followed by a debriefing.

Results and Discussion

As intended, the equality feedback significantly reduced feelings of superiority ($M_{\text{equality}} = 3.69$) relative to the superiority feedback ($M_{\text{superiority}} = 4.25$; $t(76) = 2.00, p < .05$), but did not affect uniqueness feelings ($p > .12$). In contrast to Study 3a, in which the moderator was a continuous variable (narcissism), Study 5 used a simple slope analysis (Hayes 2013) to examine the moderating role of induced feelings of equality. Regressing the number of unique product options chosen on narcissism (mean centered), performance
feedback (superiority feedback = 0, equality feedback = 1), and their interaction revealed a significant simple effect of narcissism ($\beta = .34, t(74) = 2.16, p < .05$), thereby supporting H1 in a new product context, and a qualifying significant interaction ($\beta = -.50, t(74) = -2.21, p < .05$). Estimating the same model but recoding the dichotomous moderating variable (superiority feedback = 1, equality feedback = 0) shows that induced feelings of equality eliminated the positive relationship between narcissism and product uniqueness ($\beta = -.16, t(74) = -0.99, p > .32$; see Fig. 4 for the simple slopes). These results support H5.

Studies 4 and 5 provide converging evidence for feelings of superiority standing at the center of narcissists’ desire for creating unique products (H4 and H5). Study 5 replicates the effect of narcissism on product uniqueness in a different category and provides a mechanism to mitigate narcissists’ preference for creating unique products (an issue we further discuss in the general discussion).

General Discussion

Mass customization systems allow retailing and manufacturing firms to pursue multi-channel distribution strategies while providing their customers with the opportunity to create individualized, unique products. Yet field evidence indicates that few shoppers actually use the full individualization potential of these web-based product configurators. Given the importance of this market segment in terms of product diffusion and profit margins, we sought to shed light on the nature of these consumers by examining their drivers for configuring products in such a unique way. Our findings indicate that trait and state narcissism lead consumers to express their felt superiority through the customization of unique products, thereby exploiting the largely untapped potential of MC systems.

In a series of seven studies, we established that consumers high in trait narcissism or primed with state narcissism tend to choose product options that are selected by few other consumers, therefore self-designing more unique products using MC systems (a finding we demonstrated in both durable and non-durable product categories). The state-based priming approaches provide causal evidence for the narcissism-uniqueness relationship and demonstrate how firms can promote the uniqueness of configured products through advertising (Studies 2a and 2b). In line with our reasoning, we showed that feedback regarding the uniqueness of the configured product and the product’s options differentially influences narcissistic consumers (Studies 3a and 3b). Exploring the underlying processes of
these effects, we found that feelings of superiority constitute an important motivation for narcissists when configuring a unique product, thereby establishing feelings of superiority as a mediator and boundary condition of the narcissism-uniqueness link (Studies 4 and 5). In the following sections, we explore the implications of these findings for theory, practice, and future research.

Implications for Research

While the customization literature has focused to a large extent on the advantages of MC systems (compared to conventional choice formats; e.g., Huffman and Kahn 1998; Valenzuela et al. 2009), few researchers have examined how such systems can be best designed to correspond with (and perhaps even influence) consumers’ motives. The opportunity provided by MC systems to show the world that “I made it myself” is tailored to narcissists’ inherent desire to distinguish themselves from others. In support of this, our research shows how narcissism (both as a trait and state of mind) is translated into product configuration. The mediating role of feelings of superiority demonstrates that the self-enhancing tendency of narcissists is directly influential on the self-design of their products. Indeed, the purchase and consumption of unique products allows narcissists to attract the attention of other consumers and to impress them.

A variety of reasons motivated us to focus our investigation on consumer narcissism and not on related constructs such as need for uniqueness, materialism, or egocentrism. First, narcissism is a broad personality construct with a long-standing history and is likely to underlie more specialized trait measures. Because of narcissists’ agentic self-beliefs and their strong motivation to be rewarded (Foster, Misra, and Reidy 2009), they are more likely to approach not only people but also material goods (thereby fostering materialism) and are primarily interested in rewarding themselves while ignoring others (related to egocentrism). Second, rising incidence rates have led researchers to refer to a “narcissism epidemic” (Twenge and Campbell 2009), with even the New York Times “seeing narcissists everywhere” (Quenqua 2013). Such far-reaching societal changes make it relevant to study their consequences on today’s and tomorrow’s marketing efforts. Third, narcissism is a multifaceted construct that encompasses several sub dimensions being responsible for the customization of unique products, such as narcissists’ desire for self-aggrandizement and self-enhancement (Sedikides et al. 2007), which in turn drives their need for uniqueness. Finally, narcissism can be primed and used by practitioners (as detailed in the implications for practice).
Our research contributes to the understanding of agentic self-beliefs being central to the narcissist’s self-identity. We demonstrated that a measure of superiority feelings mediated the effect of narcissism on the uniqueness of a configured product and further showed that experimentally influencing feelings of superiority moderated observed effects. Together, these findings place feelings of superiority as a key explanatory factor for the narcissist’s crave for unique products and, at the same time, shed light on the underlying reasons why consumers use MC systems. While previous research has attributed the economic value of mass-customized products to increased preference fit, design effort, and awareness of being the creator (Franke et al. 2010), our findings suggest that superior self-presentation may represent an additional factor determining the success of MC systems.

Some of the strongest findings regarding the link between narcissism and product uniqueness were obtained using state narcissism (rather than trait narcissism). The results of two experiments support our assertion that induced state narcissism increases the uniqueness of consumers’ self-designed products. These findings reflect the contention that a person’s level of narcissism can change over time, similar to Baumeister and Vohs’ (2001) state of narcissistic myopia characterized by a “heightened desire for admiration” (p. 208), and demonstrate how state narcissism can influence shoppers’ behavior. Given that our manipulation only affected state narcissism, but not related constructs such as state self-esteem, the priming results provide solid evidence for a causal relationship between consumer narcissism and the uniqueness of a configured product. Together with the extensive effects of trait narcissism and the fact that we used two different manipulations of state narcissism, our findings are generalizable across different techniques of implementation.

Implications for Practice

Consumers who self-design uncommon, unique products can speed up product diffusion and enhance profit margins because of their willingness to pay a price premium. Given their preference for unique products, narcissistic consumers (or those in a narcissistic state) are of considerable economic importance to firms employing MC systems. In the current research, we identified narcissistic consumers through the NPI-15 (Schütz et al. 2004), a well-established measure of narcissism that allows MC providing firms to identify and understand their key market segment. Are there other ways that narcissists can be identified in the marketplace?

Building on people’s tendency to outwardly express their personality via everyday cues, several strategies allow firms to identify the narcissistic consumer. First, narcissists can
be recognized by their physical appearance, as they are more likely to wear expensive, ostentatious clothing and to have a neat appearance (Vazire et al. 2008). Second, narcissists can be identified according to their work space, given that their office is likely to include specific physical characteristics (e.g., awards or self-promoting pictures of oneself). Similarly, their prominence in presentations, use of first-person singular pronouns, or salary demands can be used to determine people’s level of narcissism (Chatterjee and Hambrick 2007). Third, and most promising for firms using MC systems, narcissistic consumers can be traced online via personal web sites or online social networks. Narcissists not only spend more time on such networks, but also share more self-promoting content, use I-centered communication more frequently (e.g., in the “About me” section of Facebook), and upload more “selfies” (Buffardi and Campbell 2008; Fox and Rooney 2015).

Our empirical results, however, indicate that firms need not identify true narcissists in order to apply the findings of our research. As shown in Studies 2a and 2b, a firm can create a narcissistic state of mind using marketing communications and realize similar benefits in terms of having consumers self-design more unique products. While our final study used an ad-based manipulation, firms could use numerous promotional vehicles to create a narcissistic state. For example, a recent email-based promotion by Nike (a manufacturer that has direct consumer access through mono-brand retail stores and MC systems such as NIKEiD) pictured a customized shoe stating “My mass-customized Nike shoes look amazing.” Applying the current findings would simply require changing this tagline to a narcissist-based appeal (e.g., “My unique mass-customized Nike shoes impress”) in order to induce a narcissistic state that encourages the self-design of a truly unique product. In those instances where firms want to direct consumers toward less unique product options (e.g., if those options are more cost effective or easier to manufacture), marketers could remind narcissists that they are similar or equal to other consumers (thereby reducing feelings of superiority as demonstrated in Study 5). Similar approaches are conceivable in an environment where uniqueness is not desirable from a policy or broader societal perspective. For instance, people often do not adequately diversify their retirement plans, investing into single stocks (i.e., the unique option) instead of multiple funds or standard indices such as the S&P 500—even though the latter typically outperforms the former in the long run and therefore puts people’s financial future at risk (Harding 2013; Morrin et al. 2012).

Once narcissistic consumers have been identified or a narcissistic state of mind has been created, firms using MC systems can benefit by indicating the uniqueness of product options (e.g., via percentage shares) and / or the final, configured product itself
(e.g., by indicating how often the exact same product was configured). With such feedback, both narcissistic and non-narcissistic consumers can opt for their preferred level of product uniqueness. For example, firms could program a pop-up message to appear after consumers have configured a truly unique product, which is relatively likely given the vast number of product attributes and options within many configurators (e.g., the Audi configurator permits several million different combinations of options). If a truly unique product has been configured, firms could even allow customers to block their specific configuration for a period of time (and in return of a price premium), thereby ensuring that the configured product stays unique in the near future.

For retailing firms, MC systems provide the distinct opportunity to create and make use of new distribution channels, which in turn enable them to pursue a multi-channel distribution strategy that can increase customer satisfaction and loyalty (Wallace et al. 2004). In so doing, our findings help retailers to identify which consumers should be targeted via MC systems, and who should continue using conventional choice formats that do not require the additional effort inherent to MC (Broniarczyk and Griffin 2014; Hildebrand et al. 2014). In addition, the reported priming approaches may not only enable retailers to increase the share of consumers who exert MC systems, but also to make sure that they use the full potential of these systems by creating truly unique products. The present findings thus facilitate retailers’ customer targeting and segmentation efforts and suggest, more broadly, that MC systems are a promising (but mostly unexploited) instrument for traditional retailing firms. While customized in-store shopping is available in a few product domains (e.g., Subway sandwich or IKEA cupboard), MC bears a much larger potential for retailers such as Walmart (e.g., in-store customization of clothes or integration of MC systems on www.walmart.com).

At a broader level, our investigation illustrates that choice architectures should be built upon a deeper understanding of the consumers who make particular use of them. The reported findings demonstrate the importance of offering a variety of customizable attributes and options for markets where narcissistic consumers are likely to exist. However, an analysis of the online configurators of the 20 most-sold car brands in the US, Germany, and China reveals that the most customizable MC systems are found in the German (rather than in the US) market, while in East Asia customization is just emerging for retailers and manufacturers (Accenture 2012)—a pattern that is evident across different industries. This seems surprising in the light of narcissistic propensities being at least as high in the US than in Western Europe (Twenge and Campbell 2009), and continuously increasing in East Asia.
(Cai, Kwan, and Sedikides 2012). Indeed, firms operating in such consumer markets should consider adding more attributes and options to their MC systems. Those firms operating in markets with fewer narcissists, however, could implement our research findings by creating a narcissistic state of mind among their market segments using promotions and other marketing instruments to enhance people’s agentic self-beliefs.

**Limitations and Future Research**

As with any research, certain limitations exist that provide opportunities for future researchers. One such point regards the generalizability of our findings to purchase decisions where there is less involvement of one’s self-identity. Our studies focused on configurators from two different product categories, with both MC systems providing an opportunity for narcissists to stand out from other consumers. Possibly, narcissists would play a more subordinate role within less identity-relevant domains (e.g., the customization of utilitarian products; Berger and Heath 2007) where boasting about one’s achievements is less rewarding and self-involving. In such domains, narcissists are likely to conform to the preferences of others and place more emphasis on the functionality of the product. Therefore, research exploring consumers’ narcissistic behavior regarding non-identity products may be useful.

While the cost of the final product and its product options were available to customers in the field study, we did not provide such information in the subsequent studies to obtain an unaffected indication of preferences. This, however, may have diminished the size of our reported effects due to the supportive information that higher prices provide for unique options (i.e., more expensive products are usually also more unique). Indication of price could lead to some new and intriguing conclusions. Given that narcissistic consumers want to signal superiority and uniqueness, choosing more expensive options might be an important factor in their decisions. In other words, one can signal uniqueness either by selecting unique product options or by choosing options that are higher priced. This suggests an interesting boundary condition—it could be that narcissists choose less unique options if the associated costs can effectively signal uniqueness. Furthermore, priming of state narcissism offers some rewarding new paths for consumer researchers. For instance, when having the choice between two web-based architectures, consumers in a narcissistic state of mind should prefer and more often use MC systems rather than simply choosing from pre-configured products.

Given their desire for admiration (Baumeister and Vohs 2001) and self-affirmation (Morf and Rhodewalt 2001), narcissists are likely to exchange information with other consumers. Such social information plays a key role in modern MC systems (Hildebrand et
al. 2013; Moreau and Herd 2010), which have become increasingly connected to online social networks (so-called social configurators). For example, car manufacturers have recently launched web-based tools enabling customers to easily share, discuss, and improve their configured products. In the light of narcissists’ pronounced sensitivity to social feedback and their enhanced use of online social networks (which provide social recognition), promising future research could study how narcissists respond to and present social information about a configured product. While narcissistic consumers are likely to search for praise of their customized product on Facebook, too many “likes” may indicate that the configuration is mainstream and thus diminish its perceived uniqueness and its appeal to the narcissist. Other research aimed at understanding the role of narcissists within social configurators could be particularly useful for firms that are able to employ the inherent social power of the narcissist to further the use and adoption of MC systems within non-narcissistic segments of the market.

Conclusion

Our empirical findings indicate that narcissistic consumers (or those in a narcissistic state of mind) account for some of the heterogeneity of products configured with MC systems, as these consumers systematically deviate from the mainstream in order to define their superior identity with unique products. In the light of the distinct benefits of unique products, narcissists appear to be an important market segment for firms offering MC systems. At the same time, ever increasing narcissism rates around the globe are likely to increase demand for individualized and more colorful products—a trend that might be further enhanced by firms creating narcissistic states of mind and stands in stark contrast to Henry Ford’s vision of solely black-colored cars.
References


A: Narcissistic Priming Stimuli

You impress.
Like the new Audi A6.

B: Non-Narcissistic Priming Stimuli

You belong.
Like the new Audi A6.

Fig. 1. The ad-based priming technique used to induce a narcissistic state of mind (Study 2b).
Fig. 2. Narcissism moderates the relationship between uniqueness feedback and product evaluations (Study 3a). The vertical lines indicate the Johnson-Neyman point while the hatched areas show the region of narcissism scores for which a spotlight test reveals significant differences ($\alpha = .05$) between the two feedback conditions. As such, consumers with narcissism scores greater than 5.89 (Panel A) or 6.71 (Panel B) show increased product evaluations in the case of unique (vs. non-unique) feedback.
Fig. 3. Mediation model for the relationship between narcissism and product uniqueness (Study 4). The path coefficients are unstandardized regression coefficients. The value in parentheses (c) indicates the total effect of narcissism on product uniqueness. The indirect effect (a × b) is significant at α = .05. *p < .05; **p < .01
Fig. 4. Feelings of superiority moderate the relationship between narcissism and product uniqueness (Study 5). In contrast to Study 3a, in which the moderator was a continuous variable (narcissism), Study 5 used a simple slope analysis to examine the moderating role of induced feelings of equality.
Appendix. The 15-Item Short Form of the Narcissistic Personality Inventory  
(NPI-15; Schütz, Marcus, and Sellin 2004)

<table>
<thead>
<tr>
<th></th>
<th>A) Statement 1</th>
<th>B) Statement 2</th>
</tr>
</thead>
</table>
| 1 | A) I have a natural talent for influencing people.  
B) I am not good at influencing people. |
| 2 | A) When people compliment me I sometimes get embarrassed.  
B) I know that I am good because everybody keeps telling me so. |
| 3 | A) I prefer to blend in with the crowd.  
B) I like to be the center of attention. |
| 4 | A) I am no better or worse than most people.  
B) I think I am a special person. |
| 5 | A) I am not sure if I would make a good leader.  
B) I see myself as a good leader. |
| 6 | A) I like to have authority over other people.  
B) I don't mind following orders. |
| 7 | A) I find it easy to manipulate people.  
B) I don't like it when I find myself manipulating people. |
| 8 | A) I just want to be reasonably happy.  
B) I want to amount to something in the eyes of the world. |
| 9 | A) I have a strong will to power.  
B) Power for its own sake doesn't interest me. |
| 10 | A) I really like to be the center of attention.  
B) It makes me uncomfortable to be the center of attention. |
| 11 | A) Being an authority doesn't mean that much to me.  
B) People always seem to recognize my authority. |
| 12 | A) I would prefer to be a leader.  
B) It makes little difference to me whether I am a leader or not. |
| 13 | A) I am going to be a great person.  
B) I hope I am going to be successful. |
| 14 | A) I am a born leader.  
B) Leadership is a quality that takes a long time to develop. |
| 15 | A) I am much like everybody else.  
B) I am an extraordinary person. |
Article II


This research has been presented at the 2014 Society for Consumer Psychology (SCP) and will be presented at the 2015 Association for Consumer Research (ACR).
Examining the Global Boundaries of Mass Customization: Conventional Configuration Procedures Clash with Holistic Information Processing

Emanuel de Bellis\textsuperscript{a}
Christian Hildebrand\textsuperscript{a}
Kenichi Ito\textsuperscript{b}
Andreas Herrmann\textsuperscript{a}
Bernd Schmitt\textsuperscript{c}

\textsuperscript{a}Center for Customer Insight, University of St. Gallen, Switzerland
\textsuperscript{b}Division of Psychology & Institute on Asian Consumer Insight,
Nanyang Technological University, Singapore
\textsuperscript{c}Marketing Department, Columbia University, USA
Abstract

A large-scale field study and three cross-cultural experiments demonstrate that conventional mass customization is in conflict with holistic information processing. Specifically, attribute-by-attribute configuration (vs. choosing from prespecified alternatives) reduces product evaluations of East Asian consumers while priming habitual processing styles can increase product evaluations both in the East and West.
Information processing is inherently tied to an individual’s cultural background. For instance, Easterners share the belief that different pieces of information coexist interdependently and thus process information more holistically, whereas Westerners perceive each piece of information to exist autonomously and therefore process information more analytically (Nisbett and Masuda 2003). As a consequence, companies may fail to sell their products effectively unless they take these important cross-cultural differences into account and provide tailored marketing strategies to consumers in different markets (e.g., advertising campaigns, brand names, or user interfaces; Haig 2011).

This shortcoming is particularly pronounced for mass customization systems that allow consumers to express their unique preferences (Simonson 2005). While the popularity of such systems is increasing among Western and Eastern consumers, manufacturers still employ identical user interfaces around the globe. For example, consumers configuring an automobile at Audi’s country-specific websites in North America, Europe, or Asia always walk through exactly the same configuration procedure: first prospective car buyers select a model, then they choose an exterior color, followed by their preferred rims, a number of interior features, and other options. This sequential process of conventional attribute-by-attribute customization across Western and Eastern markets is not limited to the customization of cars but can also be found in other industries including apparel, furniture, foods, and many attribute-based service packages (see www.configurator-database.com).

In this paper, we examine the psychological consequences of such attribute-by-attribute customization and how they affect consumer decision making across different markets. Our findings based on field and lab data show that conventional attribute-by-attribute customization is especially beneficial to North American and European consumers. For East Asian consumers, selecting a product from already preconfigured products is more favorable due to their habitual, more holistic information processing style. These findings have direct implications for the design of choice architectures in both Eastern and Western markets.
THEORETICAL BACKGROUND

Mass Customization

Consumers never before had the opportunity to customize such a wide variety of products. An increasing number of companies offer web-based services that allow consumers to create their own self-designed products. The mass customization (MC) literature focused to a large extent on outcome-oriented topics such as the positive influence of MC on consumer satisfaction (Moreau, Bonney, and Herd 2011) and willingness to pay (Franke, Schreier, and Kaiser 2010). However, allowing users to customize their own products may not be uniformly beneficial to all consumers. For example, consumers’ response to customized offers may be affected by their ability to form a holistic product impression based on the sequential nature of choosing each attribute in isolation (Simonson 2005).

A more recent stream of research started examining the architecture of MC systems themselves (Bauer, Düll, and Jeffrey 2010). Valenzuela, Dhar, and Zettelmeyer (2009) showed the differential effects of customization formats on attribute tradeoffs and consumers’ perceived decision complexity. Our work contributes to this emerging stream of research examining the process and boundary conditions rather than the outcome of MC and does so across different markets. Our key hypothesis is that MC is most effective if it matches consumers’ culture-specific style of information processing.

Culture-Specific Information Processing

Individuals develop distinct patterns of information processing depending on their cultural background. Research in cross-cultural psychology has extensively documented that East Asians’ default style of information processing is holistic (sometimes also referred to as global) to the extent that they bind salient information with contextual information (Nisbett and Masuda 2003). East Asians share the belief that objects in the environment are equally important and inherently connected. As such, East Asians’ holistic style of information processing is often contrasted with Westerners’ analytic (or local) processing style. Westerners tend to focus on salient information without being distracted by contextual information, because they share the belief that objects in the environment exist of unique, independent attributes (Nisbett and Masuda 2003). As a result of the distinct styles of information processing, East Asians create more information-rich products (e.g., websites or paintings) than Westerners (Wang et al. 2012).
Prior research not only showed that consumers are surrounded by objects that reflect distinct cross-cultural patterns of perception, but also highlighted that they inherently prefer such objects. For example, Liang, Runyan, and Fu (2011) categorized over 1,000 ads from various US-American and Chinese magazines and examined whether these ads differed in their content of holistic, contextual information (e.g., activity or location information) versus more analytic, focal information (e.g., clothing or car). Their results revealed that 77% of Chinese ads and only 53% of US-American ads contained contextual information. In return, Chinese (US-American) consumers preferred products that were presented in contextualized (non-contextualized) ads. This pattern of results demonstrates that consumers favor products that match their culture-specific style of information processing.

Towards Culture-Specific Mass Customization Systems

Similar to marketing campaigns that tailor their efforts to specific markets (Han and Shavitt 1994), we propose that MC is more beneficial to consumers if it fits their predominant style of information processing. MC systems are of particular relevance not only because of their widespread use across industries and their rise in East Asia (Accenture 2012), but also because they can be aligned with consumers’ culture-specific information processing as we will show across three experimental studies.

The predominant mode of MC is designed as a bottom-up process where consumers configure a product in multiple sequential steps by choosing features attribute by attribute. Such MC systems, focusing on individual attributes instead of the fully specified product itself may inhibit East Asian consumers’ ability to form a holistic product impression, being in conflict with their habitual, more holistic processing style. Consequently, consumers who process information more holistically—such as East Asians—should experience difficulties in envisioning the product under attribute-by-attribute customization. We predict that such an inhibition of mentally simulating product use may result in negative evaluations of the customization experience and consumers’ ultimate choice (Escalas 2004; Zhao, Hoeffler, and Zauberman 2011). In contrast, a choice architecture that consists of already prespecified alternatives corresponds more to the inherent information processing style of East Asians, as this choice architecture allows consumers to envision the product more holistically and to make cross-attribute comparisons simultaneously. This focus on the product as a whole is predicted to enable East Asians to select a product whose attributes fit well together, thereby promoting increased mental simulation of product use.
**H1:** Consumers’ satisfaction with the chosen product increases if the type of choice architecture matches their culture-specific style of information processing.

**H2:** The culture-specific effect of choice architecture on consumers’ satisfaction with the chosen product is mediated by consumers’ ability to mentally simulate product use.

Inducing habitual information processing (i.e., priming Easterners holistically and Westerners analytically) may offset the detrimental effects of choice architectures that are not tailored to the culture-specific information processing of consumers (a “non-habitual” choice environment) by enhancing mental simulation of product use. For instance, while attribute-by-attribute customization forces East Asians to focus on single attributes, priming them with holistic processing prior to MC is predicted to facilitate their inherent demand to bind salient information with contextual information and to keep their focus on the overall product. Vice versa, priming Western consumers with analytic processing before choosing from prespecified alternatives simplifies their habit to focus on single attributes while a range of prespecified alternatives are offered. Figure 1 summarizes these hypotheses.

**H3:** Priming habitual information processing increases consumers’ satisfaction with the chosen product if the choice architecture is not tailored to their habitual style of information processing.

**STUDY 1**

To examine whether conventional attribute-by-attribute customization is in conflict with the holistic information processing of East Asian consumers (e.g., Japanese or Chinese), we collected field data in cooperation with a large European car manufacturer. The key dependent measure was the conversion rate of customers when configuring a car online. Conversion is defined as a completed car configuration of a prospective customer at the company’s website. The dataset included 1,360,991 unique page visitors who configured their car using the company’s online car configurator in four important markets (Japan, Singapore, China, and Canada) in 2013. In line with our proposition, attrition during the configuration process was significantly larger for consumers in East Asia as indicated by lower conversion rates in Japan (36.8%), Singapore (44.4%), and China (45.1%) relative to Canada (67.3%). This general trend is also reflected by substantially lower dealer request
rates in Japan (1.3%) relative to Canada (5.7%; see Table 1). To provide further evidence for
the hypothesis that conventional attribute-by-attribute customization is less effective when it
is not tied to East Asians’ holistic information processing, we received and analyzed
additional country-specific field data for the Chinese and German market from March to
December 2013. In line with the previous findings, Chinese customers were less likely to
return to the company’s car configurator ($M = 1.38$) relative to prospective customers in the
German market ($M = 1.73$; see Table 1). Together, these analyses of over a million
prospective car buyers across various markets provide a first hint toward conventional MC
systems being less beneficial to East Asian consumers.

However, these findings are based on correlational evidence and do not necessarily
indicate causation. In addition, the data were collected on the aggregate level such that the
psychological processes that may have led to the differential effects in Western and Eastern
markets remain unclear. Hence, we designed three cross-cultural experiments to examine the
influence of conventional attribute-by-attribute customization (as implemented by the
company reported above) relative to choosing from prespecified alternatives, thus examining
the underlying processes in a more rigorous, controlled setting. These experiments were
conducted in the German market, known for its residents with a more analytic processing
style, and in the Singaporean market, known for its residents with a more holistic processing
style. Our key hypothesis was that consumers experience more mental simulation of product
use and evaluate their customized product more favorably if the MC system matches
consumers’ habitual processing style.

**STUDY 2**

To investigate how the two predominant choice architectures succeed in different
markets, we assessed consumers’ culture-specific style of information processing before
having them configure their preferred car (either using conventional attribute-by-attribute
customization or choosing among prespecified alternatives). In study 2, we conducted a
2 (choice architecture: attribute-wise vs. prespecified) × 2 (market: Singapore vs. Germany)
between-subjects design, which aimed to test whether consumers’ satisfaction with a chosen
product is increased if the type of choice architecture matches their culture-specific style of
information processing ($H_1$).
Method

In studies 2 to 4, we recruited consumers from an online panel in Singapore and Germany via local market research companies for monetary compensation. Participants were prescreened to be in the market for a new car in the next 2 to 3 years. In study 2, consumers \((N = 180; M_{\text{age}} = 37; 49\% \text{ females})\) first completed the Kimchi similarity task (Kimchi and Palmer 1982) to assess their culture-specific style of information processing. In this task, participants are shown a triangle consisting of smaller triangles and have to indicate which of two additional figures (e.g., a square made of triangles or a triangle made of squares) is more similar to the target. Subsequently, participants were randomly assigned to one of two choice architectures; customizing a car attribute-by-attribute or choosing from a set of prespecified cars. Specifically, participants in the “attribute-wise” condition customized their car sequentially, selecting an option (e.g., phantom black) for each of three attributes (e.g., exterior color). In the “prespecified” condition, participants chose a car from a set of already preconfigured alternatives. We controlled for the overall attribute space such that the prespecified alternatives resembled all possible attribute combinations of the attribute-wise architecture. After the choice task and along with demographics, we measured consumers’ ability to mentally simulate product use via three items (e.g., “How well could you imagine your personal vehicle based on your selection?”) and their choice satisfaction via five items (e.g., “All in all, I am satisfied with my choice of car”).

Results

In support of \(H_1\), we found that when Singaporeans (vs. Germans) used the prespecified (vs. attribute-wise) choice architecture, they were more satisfied with their chosen car. Adding choice architecture and market as predictors into a two-way ANOVA revealed the predicted interaction, \(F(2, 176) = 6.98, p < .01\), and no significant main effects \((ps > .77)\). In line with our theorizing, consumers experienced an increased ability to mentally simulate driving the car when provided with their culture-specific choice architecture, that is, attribute-by-attribute customization in Germany and choosing from prespecified cars in Singapore \((H_2)\). A two-way ANOVA revealed the predicted interaction, \(F(2, 176) = 4.78, p < .05\) (no main effects; \(ps > .84)\).

Given our proposition that consumers’ analytic versus holistic information processing styles underlie this culture-specific effect, we added consumers’ information processing style (as measured by the Kimchi similarity task) as a predictor to the model. Indeed, we found converging evidence that consumers with more holistic information processing choosing
from prespecified alternatives and consumers with more analytic information processing configuring via attribute-by-attribute customization showed increased mental simulation of product use, as indicated by a significant interaction in a two-way ANOVA, $F(2, 176) = 6.32, p < .05$ (no main effects; $ps > .43$). To account for all variables within one model, we estimated a moderated mediation model as detailed in Figure 1.

In line with our predictions, we found a significant choice architecture × information processing interaction to predict mental simulation of product use, 95% CI [.04, .36], while mental simulation fully mediates the effect of choice architecture on consumers’ choice satisfaction, 95% CI [.02, .20], as indicated by the insignificance of the direct choice architecture effect, 95% CI [−.31, .20]. In sum, these findings provide support for the effects hypothesized in the conceptual model.

Discussion

Why did Easterners’ tendency to process information holistically interfere with a choice architecture that demands more analytic processing? Our findings suggest that conventional attribute-by-attribute customization inhibits East Asian consumers’ mental simulation of product use (Escalas 2004), reducing their overall choice satisfaction. To provide further support for the moderating role of culture-specific information processing, we primed consumers’ processing styles in the next study.

STUDY 3

In this study, we examined whether priming consumers with habitual information processing may offset the detrimental effects of choice architectures that are in conflict with consumers’ processing style (H3). Therefore, study 3 employed a 2 (choice architecture: attribute-wise vs. prespecified) × 2 (information processing priming: holistic vs. analytic) × 2 (market: Singapore vs. Germany) between-subjects design to examine the influence of information processing priming on consumers’ mental simulation of product use and their choice satisfaction. The priming procedure also aimed to provide additional support for the moderating role of information processing in choice architectures.

Method

Mirroring the experimental paradigm of study 2, prospective car buyers ($N = 668; M_{age} = 39; 54\%$ females) were recruited online in Singapore and Germany. Prior to the choice
task, we either induced habitual processing (i.e., priming Easterners holistically and Westerners analytically) or non-habitual processing (i.e., priming Easterners analytically and Westerners holistically). To prime a specific information processing style we used the well-established Navon letters task (Navon 1977). Participants in the “holistic priming” condition were instructed to detect large letters only, thus procedurally priming a holistic processing style, while those in the “analytic priming” condition were instructed to detect small letters only, thus procedurally priming an analytic processing style (Förster 2009). Subsequent to the priming procedure, participants either used the attribute-by-attribute architecture to customize their preferred car (attribute-wise condition) or chose from a set of prespecified cars (prespecified condition). After the choice task, we measured consumers’ mental simulation of product use and their choice satisfaction, along with a manipulation check (i.e., the Kimchi similarity task) and demographics.

Results

The manipulation check confirmed that participants in the holistic (analytic) priming condition showed more holistic (analytic) information processing, both in the Singaporean and the German sample (see Table 1). In support of H3, we found that priming Singaporeans with a holistic processing style before using the attribute-wise architecture significantly increased their ability to mentally simulate using the car and also replicated the positive effect on consumers’ choice satisfaction (see Table 1). As predicted, priming Germans with an analytic processing style before using the prespecified architecture increased their choice satisfaction. In sum, priming consumers with their habitual processing style positively affected their experience with an otherwise poorly matching choice architecture that is contrary to their culture-specific information processing (as shown in study 2).

Discussion

The causal effects of habitual priming were shown to offset the detrimental influence of conflicting choice architectures. As such, priming consumers with their habitual information processing style can provide a remedy for the negative influence of choice architectures that are not tailored towards consumers’ habitual processing styles. Yet, the implementation of a Navon letters-prime would be cumbersome in a real choice setting. Our final study therefore examined the effectiveness of information processing priming via marketing communication techniques.
This study tested whether an effective priming of consumers’ habitual processing styles can be implemented via specifically tailored advertisements and additionally measured consumers’ intention to purchase their chosen product. As such, study 4 mirrored the experimental paradigm of study 3, but applied more realistic priming stimuli.

**Method**

As in study 3, prospective car buyers \(N = 552; M_{\text{age}} = 41; 39\% \text{ females}\) were recruited online in Singapore and Germany. Manipulating holistic versus analytic processing styles, we adjusted available advertising videos of study 1’s company. As such, we created two 45s videos based on the company’s TV commercials that were displayed without sound to reduce confounds. The “holistic video” included scenes that are closely related to more holistic perceptions by focusing on overall broad-based characteristics of a car, such as power and safety. In contrast, the “analytic video” included scenes highlighting single product items, such as Xenon headlights and features of the multimedia system. A pretest on consumers of the same target population \(N = 202\) confirmed the effectiveness of the video priming technique on the Kimchi similarity task (see Table 1). The pretest also revealed that consumers remembered more car items after being primed with the analytic (vs. holistic) video, indicating the effectiveness in drawing consumers’ attention toward the constituting parts rather than the product as a whole (as under the holistic prime). Having watched either of the two videos, consumers chose their preferred car either using the attribute-wise or the prespecified architecture, followed by a measurement of consumers’ willingness to purchase the chosen car and demographics.

**Results & Discussion**

Replicating the results of study 3, priming consumers with their habitual processing styles via specifically tailored advertisements increased their intention to purchase the product if they used a choice architecture that was not tailored to their habitual style of information processing. We found that priming Singaporeans with a holistic processing style before using the attribute-wise architecture significantly increased their purchase intention. In turn, priming German consumers with an analytic processing style before using the prespecified architecture also increased their purchase intention (see Table 1). These findings
provide renewed support for H3 and suggest that marketers can benefit from implementing advertising campaigns, such as videos, that trigger habitual information processing.

**GENERAL DISCUSSION**

This research provides converging evidence that firms can benefit from tailoring modern MC systems to their customers’ culture-specific style of information processing. In essence, consumers’ processing styles establish an important boundary condition for the success of MC of multi-national companies selling their products in various markets. Based on the joint power of field and lab data, we showed a causal link between consumers’ culture-specific style of information processing and their satisfaction with the chosen product. Our findings contribute to the emerging field of cross-cultural consumer psychology and marketing (Burton 2009). Specifically, we found differential effects of culture-specific information processing on both mental simulation of product use and the overall effectiveness of two predominant choice architectures; choosing from a set of prespecified alternatives versus configuring a product via attribute-by-attribute customization. When consumers use a choice architecture that is tailored to their culture-specific information processing, they envision using a product more extensively during the purchase decision process. This, in turn, systematically influences how satisfied consumers end up with their product choices.

The combined findings of our empirical studies have implications for companies providing (or considering providing) tailored choice architectures to consumers across different markets, thereby *advancing connections* around the globe. As such, this research helps developing more effective choice architectures that nudge consumers to make choices that are beneficial for themselves (e.g., greater satisfaction with the ultimate product) as well as for companies (e.g., less attrition during the configuration procedure). Given the increasing individualization in East Asia and the constant rise of MC in these markets (Accenture 2012), the current research provides a new lens on how culture-specific information processing can be aligned with interactive choice environments.
References


Haig, Matthew (2011), Brand Failures: The Truth About the 100 Biggest Branding Mistakes of All Time, Sterling, VA: Kogan.


TABLE 1
SUMMARY OF EMPIRICAL RESULTS

<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>Key Findings</th>
</tr>
</thead>
</table>
| Study 1: Field data of a large European car manufacturer (N = 1,360,991 prospective car buyers) | Analyses of conversion rates, dealer request rates, and return rates of conventional MC systems across various Eastern and Western markets. | - Lower conversion rates in Japan (36.8%), Singapore (44.4%), and China (45.1%) relative to Canada (67.3%; χ²(3, N = 1,360,991) = 109,332.48, p < .001).  
- Lower dealer request rates in Japan (1.3%) relative to Canada (5.7%; χ²(1, N = 1,139,046) = 13,491.04, p < .001).  
- Lower return rates in China (M = 1.38) relative to Germany (M = 1.73; t(1,239,891) = 18.57, p < .001). |
| Study 2: Lab experiment in Singapore and Germany (N = 180 consumers) | 2 (choice architecture: attribute-wise vs. prespecified) × 2 (market: Singapore vs. Germany) between-subjects design | - Empirical support for a moderated mediation model (see Figure 1).  
- Interaction of choice architecture × information processing to predict mental simulation of product use, 95% CI [.04, .36].  
- Mental simulation fully mediates the effect of choice architecture on consumers’ choice satisfaction, 95% CI [.02, .20], as indicated by the insignificance of the choice architecture effect, 95% CI [–.31, .20]. |
| Study 3: Lab experiment in Singapore and Germany (N = 668 consumers) | 2 (choice architecture: attribute-wise vs. prespecified) × 2 (information processing priming: holistic vs. analytic) × 2 (market: Singapore vs. Germany) between-subjects design | - A manipulation check confirmed that the analytic (holistic) priming increased analytic (holistic) information processing, both in the Singaporean sample, t(407) = 2.68, p < .01, and the German sample, t(283) = 1.77, p < .05.  
- Priming Singaporeans with holistic processing before using the attribute-wise architecture increased their mental simulation of product use, t(205) = 1.41, p = .08, as well as consumers’ choice satisfaction, t(205) = 1.69, p < .05.  
- Priming Germans with analytic processing before using the prespecified architecture increased their choice satisfaction, t(114) = 2.45, p < .01. |
| Study 4: Lab experiment in Singapore and Germany (N = 552 consumers) | 2 (choice architecture: attribute-wise vs. prespecified) × 2 (information processing priming: holistic vs. analytic) × 2 (market: Singapore vs. Germany) between-subjects design | - A pretest (N = 202) confirmed that the analytic (vs. holistic) video increased analytic information processing, t(200) = 1.65, p < .05, along with remembered car items, t(200) = 2.20, p < .05.  
- Priming Singaporeans with holistic processing before using the attribute-wise architecture increased their intention to purchase the product, t(205) = 1.64, p = .05.  
- Priming Germans with analytic processing before using the prespecified architecture increased their intention to purchase the product, t(134) = 1.61, p = .05. |
Figure 1. Conceptual model of how consumers’ analytic vs. holistic information processing styles and mental simulation of product use influence the effect of choice architecture on choice satisfaction. Note that while information processing styles are culturally determined, they can also be primed as a current state of mind.
Article III


The final publication is available at:
Cross-National Differences in Uncertainty Avoidance Predict the Effectiveness of Mass Customization across East Asia: A Large-Scale Field Investigation

Emanuel de Bellis\textsuperscript{a}
Christian Hildebrand\textsuperscript{a}
Kenichi Ito\textsuperscript{b}
Andreas Herrmann\textsuperscript{a}

\textsuperscript{a}Center for Customer Insight, University of St. Gallen, Switzerland
\textsuperscript{b}Division of Psychology & Institute on Asian Consumer Insight, Nanyang Technological University, Singapore
Abstract

Why does mass customization succeed in some East Asian markets but fail in others? Building on and extending prior work on uncertainty avoidance, this research suggests that providing mass customization in highly uncertainty-avoiding cultures can have negative consequences for consumers and companies, including longer configuration duration, lower conversion rates to actually purchase the customized product, and a reduced degree of sharing one’s product with other consumers. We provide support for those propositions based on two large-scale field studies involving more than 700,000 prospective car buyers in Japan and Taiwan (scoring high on uncertainty avoidance) versus China and Singapore (scoring low on uncertainty avoidance). Our findings on actual customers suggest that neglecting cross-national differences in uncertainty avoidance across East Asia puts both consumers and companies at risk due to more onerous customization experiences for consumers and substantially lower conversion for companies.
Main Body

1 Introduction

A new consumer trend in East Asia is a “quest for customized products and the thrill of ‘co-creation’ collaborations between consumers and product manufacturers” (Accenture 2012, p. 2). To be effective though, consumers need to have at least some insight into their own preferences when customizing products based on a large number of available features and combinations thereof (Simonson 2005). This research proposes that consumers’ uncertainty involved in such a configuration process may have varying and sometimes unintended consequences among East Asian consumers given that East Asian cultures differ greatly in their degree of uncertainty avoidance (Hofstede et al. 2010). Differences in uncertainty avoidance have been shown to affect consumers’ willingness to buy new product offerings, with high (vs. low) uncertainty-avoiding countries being more reluctant to adopt newly developed products and technologies (Lynn and Gelb 1996; van Everdingen and Waarts 2003; Yeniyurt and Townsend 2003). These findings are particularly important in a mass customization context where consumers face uncertainty with both the functionality of the product (given a typically more complex choice environment; Hildebrand et al. 2014) and their ability to contribute effectively during the configuration process.

Whether or not such differences in uncertainty avoidance affect people’s consumption behavior beyond traditional comparisons between Eastern and Western cultures is widely unknown. The majority of cross-cultural research treated individuals from different East Asian countries as homogenous subjects of a largely identical group (e.g., Lehman et al. 2004), because researchers aimed to verify cultural frameworks developed in Western countries by testing them in East Asia. The resulting “East-West” comparisons, such as interdependent versus independent self-construal (Markus and Kitayama 1991) or holistic versus analytic cognition (Nisbett 2003), received tremendous research and media coverage during the past decades. In contrast, academic work on inter-Asian differences has attracted some attention in management and cross-cultural psychology (e.g., Ang and Schmitt 1999; Cheng et al. 2014; Oyserman et al. 2002), but is still in its infancy in the area of marketing and consumer behavior (Schmitt 2013). Despite uncertainty avoidance being one of the most defining cultural differences between East Asian countries (Hofstede et al. 2010), research on the consequences of uncertainty avoidance on East Asians’ consumption behavior is rare (see Frank et al. 2012 as a recent exception).
The current work addresses this lack of understanding within and across East Asian markets by presenting empirical evidence from two field studies examining the actual behavior of over 700,000 prospective car buyers. Our findings reveal that car buyers in Japan and Taiwan (scoring high on uncertainty avoidance) invest more time when customizing their preferred automobile relative to car buyers in China and Singapore (scoring low on uncertainty avoidance). Despite substantially longer configuration duration, consumers from high (vs. low) uncertainty-avoiding countries are less likely to actually buy the configured car. We also provide counter-intuitive evidence that Japanese (vs. Chinese) consumers share their car configurations less often with other consumers in spite of their distinct need to reduce uncertainty. These findings are put into perspective with regard to the high prevalence of *taijin kyofusho* in Japan (the concern to embarrass others) as well as the Japanese concept *wa* (the tendency to maintain harmony among individuals).

Overall, our analyses of actual customers reveal highly distinct behaviors across four major East Asian countries. These findings have important implications for firms already operating in or considering entering markets in East Asia. In what follows, we develop four focal hypotheses that build on cross-national differences in uncertainty avoidance. We then present the results from two large-scale field studies and discuss the theoretical and managerial implications for both single-culture and cross-cultural marketing.

### 2 Theoretical background and hypotheses

While mass customization (MC) is becoming increasingly popular in East Asia (Accenture 2012), customizing a product for oneself involves a considerable degree of uncertainty during the configuration process. Dealing with a large number of product features, estimating the product’s functionality based on the selected features and combinations thereof, and assessing others’ approval of the customized product exposes a consumer to much more uncertainty than choosing a standard off-the-shelf product (Broniarczyk and Griffin 2014; Dellaert and Stremersch 2005; Hildebrand et al. 2014). A consumer’s response to the uncertainty inherent in such a configuration process is critical in East Asia given that research from different domains revealed ample differences in uncertainty avoidance among East Asian countries (Hofstede et al. 2010; Quintal et al. 2010).

The cross-national concept of uncertainty avoidance is defined by the degree to which a country’s residents deal with uncertainty regarding a future environment, and is one of the five cultural dimensions that were proposed and extensively discussed by Hofstede and colleagues. In his classic field study on IBM employees in over 70 countries, Hofstede (2001)
identified that individuals’ stress levels at work strongly correlated with their perceived employment stability in the future and their unwillingness to violate company rules. Importantly, he showed that the strength of this correlation differs substantially across countries and argued that these differences stem from culture combating individuals’ tendencies to feel insecure about unknown future events. In delineating the concept of uncertainty avoidance, Hofstede (2001) distinguished uncertainty avoidance from risk avoidance. Whereas the perception of risk is related to a specific event to be feared, uncertainty is perceived when one is unable to foresee what will happen next. Other researchers conceptualized uncertainty avoidance as individuals’ reliance on implicit or explicit rules, structures, and relationships to escape from the ambiguity in everyday life (Yaveroglu and Donthu 2002). For example, a country’s dominance of religious beliefs is associated with the degree of uncertainty avoidance because it provides individuals in high uncertainty-avoiding countries with answers for many unanswerable questions that make people’s lives ambiguous (e.g., life after inevitable death). Indeed, anthropologists showed that religiosity is more prominent in East Asian countries scoring high on uncertainty avoidance (e.g., Japan) relative to those scoring low (e.g., China; Hsu 1971).

Uncertainty avoidance has been suggested as one of the most defining cultural differences among East Asians (Frank et al. 2012; Hofstede et al. 2010). For instance, while Japanese, Taiwanese, Chinese, and Singaporeans are considered as both interdependent and holistic thinkers (Markus and Kitayama 1991; Nisbett 2003), they differ greatly from one another on the dimension of uncertainty avoidance. According to Hofstede et al.’s (2010) uncertainty avoidance index, Japanese (92 out of 100) and Taiwanese (69) score high on uncertainty avoidance while Chinese (30) and Singaporeans (8) score low on uncertainty avoidance. This central cultural difference has also been shown to affect individuals’ consumption patterns. Consumers in high (vs. low) uncertainty-avoiding cultures tend to be less innovative and entrepreneurial, while their consumption is more conscientious (e.g., they consume less processed foods, buy more designer furniture, and choose mineral water over tap water; de Mooij and Hofstede 2002). Taken together, these characteristics of uncertainty avoidance suggest that individuals in high (vs. low) uncertainty-avoiding countries prefer a decision context that is free of potential ambiguity. In an MC context, in which clear decision strategies for one’s preferred configuration are lacking, we predict that consumers in high (vs. low) uncertainty-avoiding countries take longer to configure their preferred product. More formally, we hypothesize:
H1: Prospective car buyers in high uncertainty-avoiding markets have a longer duration to complete the configuration process relative to prospective car buyers in low uncertainty-avoiding markets.

Hofstede (2001) and Hofstede et al. (2010) also proposed that uncertainty avoidance corresponds to consumers’ level of anxiety toward an ambiguous, unpredictable, and uncertain future. For example, consumers in high (vs. low) uncertainty-avoiding countries value conservative over adventurous choices and are more ambiguity-averse to the extent that they hesitate to dive into a new and unknown situation. The inherent anxiety associated with uncertainty avoidance may have behavioral consequences for the effectiveness of MC offerings. For example, in the early 2000s, when the Internet was perceived as a new and technologically sophisticated medium associated with a considerable degree of uncertainty, consumers in high (vs. low) uncertainty-avoiding countries needed more reassurance and tools to reduce uncertainty in order to facilitate their online purchases (Singh et al. 2005). While customization has been present for centuries (e.g., home building or bespoke suits), consumers’ ability to efficiently customize mass-produced consumer goods by making use of modern rendering technologies and choosing from a plethora of features is a dominant global trend across consumer markets (especially in East Asia; Accenture 2012). However, the uncertainty associated with such a feature-rich choice environment may have detrimental consequences for consumers high in uncertainty avoidance. Specifically, we propose:

H2: Prospective car buyers in high uncertainty-avoiding markets are less likely (a) to complete the configuration process and (b) to purchase the customized car relative to prospective car buyers in low uncertainty-avoiding markets.

How does configuration duration relate to one’s probability to purchase a customized product? If, as proposed under H1, consumers from high (vs. low) uncertainty-avoiding countries invest more time into the configuration process, this may have consequences for their actual purchase probability as well. In the context of e-commerce websites, Sismeiro and Bucklin (2004) have shown that website visitors were less likely to buy a product when they returned to the retailer’s website more frequently. While one could argue that longer configuration duration is related to larger product involvement, prior work has shown that longer task completion times are indicative of greater consumer uncertainty (Greenleaf and Lehmann 1995). Given these findings, we propose that configuration duration mediates the
effect of cross-national differences in uncertainty avoidance on consumers’ probability to purchase the customized product. Thus, we hypothesize:

H3: Longer configuration duration decreases the probability to purchase a customized car, resulting in lower conversion rates.

In today’s competitive market environments, companies not only aim to increase the purchase probability of a focal consumer, but also seek ways to maximize product diffusion and electronic word-of-mouth. In the light of the “interconnected, mobile [East Asian] consumer who wants to use consumer technology to make shopping fun, fast and collaborative” (Accenture 2012, p. 2), consumers’ willingness to share their customized product with fellow consumers is particularly important in East Asia. A dominant finding in prior research is that uncertainty avoidance causes individuals to avoid social outings because of the fear of embarrassment and negative evaluation by others (Arrindell et al. 2004). In addition, uncertainty avoidance may strengthen the predisposition of culture-specific concepts of interpersonal relationships on consumers’ advice-seeking behavior (Steenkamp et al. 1999). This is particularly important with respect to the Japanese culture because of the relatively high prevalence of taijin kyofusho (TKS), as individuals with TKS are highly concerned that their behavior will offend or embarrass another person (Hofmann et al. 2010). In such an environment, consumers may hesitate to seek advice from others and to share their configuration. Also, the meaning of acquiring and maintaining interpersonal relationships differs fundamentally across East Asia. For example, the Chinese concept guanxi is based on the exchange of utilitarian favors among individuals, while the Japanese concept wa refers to horizontal harmony among group members which is maintained through consensus building and avoidance of conflict (Cheng et al. 2014). From this perspective, asking others to comment on a customized product to achieve one’s self-interests is likely to be socially acceptable in China, but less so in Japan. Therefore, we propose:

H4: Prospective car buyers in high uncertainty-avoiding markets share their customized product less often with others relative to prospective car buyers in low uncertainty-avoiding markets.

The above hypotheses about the effects of cross-national differences in uncertainty avoidance on consumers’ purchase and social sharing behavior are summarized in Fig. 1. Solid lines represent hypothesized effects while the dashed line indicates an exploratory
effect. We do not provide a formal hypothesis (due to the lack of directionality) but will test the effect of social sharing on consumers’ purchase probability in section 4.2.

![Fig. 1 Summary of hypotheses (solid lines are hypothesized; dashed line is exploratory)](image)

3 Field study 1

In collaboration with a large Western car manufacturer, we conducted a field study to examine whether consumers in high (vs. low) uncertainty-avoiding countries show longer configuration duration (H1) and reduced configuration completion (H2a) when customizing their preferred car.

3.1 Data and measurement

Across all analyzed markets, the car manufacturer employs exactly the same MC interface which guides consumers through the configuration process by letting them select each product attribute individually (i.e., one’s preferred engine, exterior color, wheels, interior features, and add-ons), which has previously been conceptualized as by-attribute customization (Valenzuela et al. 2009). To test our hypotheses, the car manufacturer developed an MC tracking software that was incorporated in each market. When prospective car buyers entered the MC interface to configure their preferred car, the tracking software collected data on whether consumers completed their configuration (referred to as configuration completion) and the time span from starting the configuration until completion (referred to as configuration duration). Data were collected during 1 year (January 1 to
December 31, 2013) for a total of 686,003 prospective car buyers who configured their preferred car in the Japanese, Taiwanese, Chinese, or Singaporean market.

3.2 Results

In line with our theorizing, we find that prospective car buyers in Japan and Taiwan (high in uncertainty avoidance) showed considerably longer configuration duration relative to those in China and Singapore (low in uncertainty avoidance). As such, Japanese and Taiwanese consumers took about 21 min to complete their car configuration whereas Chinese and Singaporean consumers only spent 19 and 14 minutes, respectively (\(M_{Japan} = 20.94\) min, \(M_{Taiwan} = 21.16\) min, \(M_{China} = 18.88\) min, \(M_{Singapore} = 13.63\) min; \(F(1, 442,697) = 56.88, p < .001\); see Fig. 2a). In support of H1, post-hoc analyses reveal that all pairwise comparisons are significant (\(ps < .001\)) except the one between the Japanese and Taiwanese markets (\(p > .51\)). Interestingly, while investing more time, Japanese and Taiwanese consumers were less likely to complete their configuration. As shown in Fig. 2b, only 36.8 and 38.0 % of prospective car buyers in Japan and Taiwan completed their car configuration relative to a significantly larger fraction of 45.1 and 44.4 % in China and Singapore, respectively (\(\chi^2 = 4180, p < .001\)). Post-hoc analyses reveal that all pairwise comparisons are significant (\(ps < .001\)) apart from the one comparing the Chinese and the Singaporean markets (\(p > .10\)). These results provide converging support for H2a.

Fig. 2  Study 1: prospective car buyers in high uncertainty-avoiding markets (a) invested more time into the configuration process and (b) were less likely to complete it relative to those in low uncertainty-avoiding markets
In sum, we find that although prospective car buyers in Japan and Taiwan showed significantly longer configuration duration when customizing their preferred car, they were less likely to actually complete the configuration process relative to consumers in China and Singapore. Even though the reported effects are large and in line with our hypotheses, the aggregate nature of the data does not allow any inference on the individual level. To provide a remedy to this limitation, we conducted a follow-up study that enabled a more in-depth analysis of East Asians’ distinct usage of MC interfaces.

4 Field study 2

To make inferences above and beyond the aggregate data of study 1, we collaborated with the same car manufacturer as in study 1 and implemented an improved MC tracking software in the Japanese and Chinese markets, Asia’s two largest economies and automobile markets. Study 2 examines the behavioral consequences of configuration duration (H3) and tests whether consumers in high (vs. low) uncertainty-avoiding countries show lower conversion rates (H2b) and reduced social sharing behavior (H4) when customizing their preferred car.

4.1 Data and measurement

This study allows an individual-level analysis of consumers’ configuration processes by leveraging and combining dealer sales data (as indicated by an entry in a car dealer’s database) with the behavioral data of the MC tracking software. Data sources were linked by unique identifiers of an individual car configuration via a user’s device-specific hardware ID and a tracking code that is tied to a configuration and changes thereof. This adjustment enables the analysis of prospective car buyers’ behavior over the time span from first visiting the MC interface until the final lead entry in the car dealer’s database, which typically lasts several days or weeks (and is therefore referred to as overall configuration duration). Most importantly, we were able to analyze whether or not a configured car was purchased (referred to as conversion rate). In addition, the software tracked whether consumers sent their car configuration to a self-selected person via the manufacturer’s MC interface (referred to as social sharing). Study 2 involves 78,978 car configurations from 42,074 prospective car
buyers who had at least one but no more than 20 car configurations. Data were collected over a time span of 6 months (February 22 to September 1, 2014) in Japan and China.

4.2 Results

Similar to study 1, Japanese car buyers showed significantly longer overall configuration duration relative to Chinese car buyers. Specifically, analyzing those customers who returned at least once to the MC interface and eventually triggered a dealer request, Japanese (vs. Chinese) took five times as long from their first configuration until their final dealer configuration, with about 10 days in Japan relative to 2 days in China ($M_{Japan} = 9.92$ days, $M_{China} = 1.73$ days; $t(5282) = 16.33, p < .001$). Follow-up analyses revealed that Japanese customers had both higher return frequencies ($M_{Japan} = 3.49$ vs. $M_{China} = 3.16$; $t(5282) = 4.31, p < .001$) and longer time spans between two single configurations ($M_{Japan} = 68$ h vs. $M_{China} = 13$ h; $t(5282) = 15.49, p < .001$). These results provide additional support for H1.

In line with our previous findings on the behavioral consequences of uncertainty avoidance, consumers’ configuration completion was significantly lower in Japan (39.1 %) compared to China (59.8 %; $\chi^2 = 12,827, p < .001$), replicating the results from study 1. Most importantly, conversion rates from a consumer’s first configuration to his or her actual purchase differed greatly between markets with 18.3 % (18,959 out of 103,578 started configurations) in China and only 2.3 % (5,803 out of 255,847 started configurations) in Japan ($\chi^2 = 29,554, p < .001$). These results are summarized in Fig. 3 and provide strong support for H2a and H2b.

---

3 A total of 318 consumers (or less than 1 % of the sample) had more than 20 configurations and were likely to correspond to external dealer configurations, as noted by the company providing the data. Consequently, we removed these cases from all subsequent analyses. The reported results are robust and do not change if including these observations.
Fig. 3  Study 2: prospective car buyers in Japan (high in uncertainty avoidance) had a lower configuration completion rate, fewer dealer requests, and a reduced conversion rate relative to those in China (low in uncertainty avoidance).

A logit model predicting consumers’ conversion (non-purchase [coded as 0] vs. purchase [coded as 1]) based on their overall configuration duration reveals the expected negative effect: As prospective car buyers took longer for the configuration process they were less likely to actually purchase the configured car ($\beta_{\text{configuration duration}} = -0.21, p < .001$).\(^4\) Controlling for the respective market, both main effects remain negative and significant ($\beta_{\text{configuration duration}} = -0.09, p < .001; \beta_{\text{Japan vs. China}} = -1.18, p < .001$), while their interaction is non-significant ($\beta_{\text{configuration duration } \times \text{ Japan vs. China}} = 0.07, p > .10$). In support of the proposed process explanation (see Fig. 1), a mediation model with bootstrapped estimates (Preacher and Hayes 2008) shows that the effect of high versus low uncertainty-avoiding markets on conversion rates is mediated by consumers’ configuration duration ($a \times b = -0.010$, with a

\(^4\) Additional analyses indicate that both higher return frequencies ($\beta = -0.46, p < .001$) and longer time spans between two single configurations ($\beta = -0.17, p < .001$) are negatively related to purchase probability, in line with prior work (Greenleaf and Lehmann 1995; Sismeiro and Bucklin 2004).
95% confidence interval excluding zero \([-0.014 \text{ to } -0.005]\)), while the direct effect is reduced but yet significant \((c' = -1.20)\), indicating partial mediation. These results confirm H3 and demonstrate that Japanese consumers’ increased time investment into the configuration process decreases (rather than increases) their tendency to actually purchase the customized car.

While investing more time into the configuration process, Japanese consumers were less likely to share their configuration with other consumers. In support of H4, only 0.13% of prospective car buyers in Japan shared their configuration relative to 0.28% in China \((t(42072) = 3.11, p < .001)\). Counter to intuition, sharing a configuration with others was associated with reduced conversion rates. Controlling for the respective market, both main effects remain negative and significant \((\beta_{\text{social sharing}} = -0.12, p < .001; \beta_{\text{Japan vs. China}} = -1.20, p < .001)\), while their interaction is non-significant \((\beta_{\text{social sharing} \times \text{Japan vs. China}} = -0.08, p > .37)\).

Given the increased attention of social sharing in recent consumer research, this finding highlights the need for further (both single-culture and cross-cultural) research on the consequences of social sharing and is discussed in more detail in section 5.

5 General discussion

Based on a large-scale field investigation involving over 700,000 prospective car buyers in four major East Asian countries, the current research identified cross-national differences in uncertainty avoidance as an important driver of how consumers deal with MC offerings in East Asia. We showed that consumers in high uncertainty-avoiding markets (Japan and Taiwan) had substantially longer configuration duration, were less likely to purchase their customized car, and were less inclined to share their configuration with others relative to consumers in low uncertainty-avoiding markets (China and Singapore). These findings contribute to the emerging fields of research on MC, socially-enriched choice environments, and cross-cultural marketing, including the study of East Asian consumers.

While the majority of prior work on MC has examined outcome-related factors such as consumers’ increased satisfaction with a customized product or their willingness to pay (e.g., Valenzuela et al. 2009), our findings suggest that consumers from high uncertainty-avoiding countries perceive customizing their own product as more onerous, with negative consequences such as ultimately lower conversion rates for companies. A similarly hot topic is the ubiquitous online social sharing activity with other consumers. This is the first series of studies demonstrating that social sharing is substantially reduced in high (vs. low) uncertainty-avoiding cultures. From an uncertainty avoidance standpoint, we suggest that this
seemingly counter-intuitive finding can, at least partly, be explained by individuals’ avoidance of social outings and their inherent wish not to offend others, which aligns with the prevalence of *taijin kyofusho* and the concept *wa* in the Japanese culture. Importantly, while only few consumers shared their configuration with others, the negative effect of social sharing on consumers’ purchase probability adds to the field of socially-enriched choice environments and is in line with recent findings showing that the use of social media can have unintended, negative consequences for both consumers and firms (Hildebrand et al. 2013).

From a broader perspective on cross-cultural marketing, our work contributes to the development of research on the similarities and differences between East Asian societies. For more than 30 years, cross-cultural researchers have demonstrated the importance of culture on human cognition and behavior, primarily by comparing East Asians with North Americans or Western Europeans. This line of research has successfully established the perspective that one cannot comprehend consumption behavior independent of the cultural environment. However, the paradigm of East-West comparisons has been criticized for focusing mainly on Japan/China and the USA (Henrich et al. 2010) and for its failure to acknowledge differences within Eastern and Western cultures (Oyserman et al. 2002). The current findings contribute to more nuanced cross-cultural research, as they highlight the behavioral consequences of (neglecting) cultural differences within East Asia. In particular, we built on the concept of uncertainty avoidance—the degree to which a society deals with uncertainty regarding the future (Hofstede 2001)—as a defining characteristic to aid in understanding East Asian cultures. In line with recent work of Frank and colleagues (e.g., Frank et al. 2012), we demonstrated that East Asian markets and their consumers’ behavior differ greatly, with important consequences for firms operating in or considering entering these markets.

Despite these contributions, we acknowledge the limitations inherent in using industry field data. As such, we have not experimentally manipulated uncertainty avoidance to isolate the proposed effects in a more controlled setting. However, given prior work on uncertainty avoidance in East Asia (Frank et al. 2012; Hofstede et al. 2010) and the large datasets used in this research, we believe that the current results are robust. In addition, the analysis of four different countries controls for potentially confounding factors arising from differences on economic or other cultural dimensions. For instance, GDP per capita is comparable between Japan, Taiwan, and Singapore, while China and Taiwan share a similar historical background. As such, the results of this large-scale field investigation hold even after controlling for other major differences at the country level.
With respect to future directions, one particularly puzzling observation relates to Japanese consumers being perceived as technology mavens with a strong affection for new technologies and unique products. The present research provides a more nuanced observation and suggests that using advanced MC interfaces does not equal actual purchase. Future research may examine the antecedents that cause such discrepancies as well as potential strategies to assist consumers from high uncertainty-avoiding cultures when navigating through potentially complex choice environments, such as by-alternative instead of by-attribute customization (Valenzuela et al. 2009) or customization via starting solutions (Hildebrand et al. 2014). Besides contributing to the emerging field of consumer decision making in electronically-enhanced choice environments, such research would enhance our understanding of the behavioral consequences of East Asia’s crave for customized products.
References


Article IV


The final publication is available at:
Die 3-K-Erfolgsfaktoren von Mass Customization

Emanuel de Bellis

\footnote{Center for Customer Insight, University of St. Gallen, Switzerland}
Zusammenfassung

Während Mass Customization in vielen Industrien ein fester Bestandteil des Marketings geworden ist, besteht unter Marketingmanagern nach wie vor Unklarheit über die zugrundeliegenden Mechanismen und Stellhebel. Der Beitrag beleuchtet anhand aktueller Forschungsergebnisse eine Reihe wichtiger Erfolgsfaktoren und ordnet sie drei Säulen zu.
Hauptteil


--- Abb. 1 hier einfügen ---


--- Abb. 2 hier einfügen ---
Säule 1: Der konfigurierende Konsument


Attributen und Entscheidungen in vielen Konfiguratoren überwältigt sein – und deshalb eine niedrigere Entscheidungszufriedenheit aufweisen oder gar zum Nicht-Kauf tendieren. So konnte gezeigt werden, dass der Erfolg von MC insbesondere auf denjenigen Konsumenten beruht, welche (1) einen besseren Einblick in ihre eigenen Präferenzen haben, (2) ihre Präferenzen besser ausdrücken können, und (3) eine höhere Involvierung in das Produkt aufweisen (Franke/Keinz/Steger 2009). Gleichzeitig wird aber auch argumentiert, dass die Konfiguration von Produkten das Erlernen der eigenen Präferenzen (zumindest mittel- bis langfristig) erleichtern kann.

Die erste Säule hat gezeigt, dass die Persönlichkeitseigenschaften eines Konsumenten bei der Benutzung von MC eine bedeutende Rolle spielen. Trotzdem ist erstaunlich wenig darüber bekannt, inwiefern der Erfolg von MC auf den spezifischen Charakteristiken eines Konsumenten beruht, obwohl sich dadurch wertvolle Informationen zur Kundensegmentierung gewinnen lassen und Konfigurationen sogar in eine bestimmte Richtung (z.B. mehr Einzigartigkeit) gelenkt werden können.

Säule 2: Kontext der Konfiguration


Neben diesen generischen Unterschieden zwischen Ost und West darf nicht vernachlässigt werden, dass gerade in den asiatischen Wachstumsmärkten grundlegend verschiedene Kulturen existieren und dass sich deren Konsumenten aufgrund des neu
erlangten Wohlstands auch lokal stark voneinander unterscheiden. So zeigen die Daten eines deutschen Fahrzeugherstellers, dass der Erfolg von MC stark vom unterschiedlichen Grad der Unsicherheitsvermeidung (*uncertainty avoidance*; Hofstede/Hofstede/Minkov 2010) abhängt. Konsumenten mit niedriger Unsicherheitsvermeidung (z.B. Chinesen) benötigen im Vergleich zu denjenigen mit hoher Unsicherheitsvermeidung (z.B. Japaner) mehr Zeit, um eine Konfiguration abzuschliessen, was sich negativ auf ihre Kaufwahrscheinlichkeit auswirkt (de Bellis et al. 2015b). Trotz ihrem Drang, die innere Unsicherheit zu vermeiden, teilen erstere Konsumenten ihre Konfiguration deutlich seltener via Email oder soziale Medien mit anderen Konsumenten. Diese Feldergebnisse deuten darauf hin, dass in Märkten mit hoher Unsicherheitsvermeidung Werkzeuge (z.B. Online Assistenzsysteme) zur Verfügung gestellt werden sollten, welche es Kunden erlauben, ihre inhärente Unsicherheit zu vermindern.


häufiger mobil konfiguriert werden, ist noch gänzlich unklar, wie sich dies auf das Kundenerlebnis auswirkt.


**Säule 3: Design des Konfigurators**


Neben der Veränderung der Grundstruktur eines Konfigurators ist relativ wenig darüber bekannt, wie einzelne Bausteine den Entscheidungsprozess von Konsumenten beeinflussen. Ein solcher Baustein besteht bspw. im Setzen von Defaults, also der voreingestellten Auswahl eines Attributlevels, was Konsumenten als Navigationshilfe durch den Konfigurationsprozess dienen kann (Beck 2014). Um das volle Potenzial von MC auszuschöpfen, wäre es zudem denkbar, dass dem Konsumenten am Ende einer Konfiguration mitgeteilt wird, ob seine Konfiguration einzigartig ist (d.h. ob kein anderer Konsument das exakt gleiche Produkt konfiguriert hat, was bei komplexen Konfiguratoren oftmals zutrifft). Wenn dem so ist, könnten Unternehmen die Option anbieten, die genau
gleiche Konfiguration (gegen einen Aufpreis) sperren zu lassen, um die Einzigartigkeit des Produkts auch in naher Zukunft zu gewährleisten. Eine weitere Möglichkeit besteht im Einbau von spielerischen Bausteinen in Konfiguratoren (product gamification; Deterding et al. 2011). Studienergebnisse zeigen, dass bspw. das Freispielen einzelner Attributlevels als Herausforderung wahrgenommen wird, was wiederum das Kundenerlebnis verbessern kann (Schlager et al. 2015).

Interessant erscheint der Umstand, dass relativ wenig über das eigentliche Kunden- und Klickverhalten im Konfigurator bekannt ist. Vor diesem Hintergrund hat der Autor eine MouselabWeb-Studie (siehe www.mouselabweb.org) durchgeführt, bei der 136 deutsche Konsumenten einen nachgeahmten Fahrzeugkonfigurator präsentiert bekamen und anhand von insgesamt 44 Attributlevels ihr Wunschfahrzeug zusammenzustellen konnten. Die Ergebnisse zeigen, dass der Name sowie der Preis eines Attributlevels im Durchschnitt ca. drei Mal konsultiert wurden (M$_{\text{Name}}$ = 2.66; M$_{\text{Preis}}$ = 3.30), während dem Bild überdurchschnittlich viel Aufmerksamkeit zukam (M$_{\text{Bild}}$ = 6.16). Ebenfalls interessant erscheint der Umstand, dass die Angabe des Marktanteils eines Attributlevels gleich oft geöffnet wurde wie dessen Name (M$_{\text{Marktanteil}}$ = 2.66). Dies hebt die Wichtigkeit von visueller Information hervor und deutet darauf hin, dass Konsumenten Hinweise auf die Einzigartigkeit eines Attributlevels in ihren Entscheidungsprozess integrieren – sei es, um das eigene Produkt besonders einzigartig zu gestalten, oder um nicht von der Norm abzuweichen. Um mehr über den zugrundeliegenden Konfigurationsprozess zu erfahren, könnte zukünftige Forschung untersuchen, welche Entscheidungsstrategien Konsumenten verfolgen und ob simple Heuristiken den Konfigurationsprozess am besten abbilden, ähnlich wie in anderen Domänen (z.B. Essensentscheidungen; Schulte-Mecklenbeck et al. 2013).

Dieser Abschnitt hat gezeigt, dass Hersteller anhand der Wahl eines geeigneten Konfigurationsformats sowie durch die Integration von verschiedenen Bausteinen grossen Handlungsspielraum haben, um das Kundenerlebnis von MC zu optimieren. Abb. 3 fasst die abgeleiteten Erfolgsfaktoren zusammen.

--- Abb. 3 hier einfügen ---

**Fazit und Ausblick**

Der zunehmende Erfolg von Mass Customization hat die Marketingdisziplin im letzten Jahrzehnt stark verändert. Mittels internetbasierter Konfiguratoren ist es heute in vielen Industriezweigen möglich, Produkte exakt auf die individuellen Kundenbedürfnisse

Ein Faktor, der in diesem Artikel bewusst ausser Acht gelassen wurde, ist das zu konfigurierende Produkt und die dahinterstehende Industrie (siehe Pollard et al. 2008), um möglichst universale Handlungsempfehlungen zu geben. Auch erhebt die vorgenommene Auflistung der Erfolgsfaktoren keinen Anspruch auf Vollständigkeit; die drei Säulen sollen vielmehr als mögliche Klassifikation für weitere Erfolgsfaktoren dienen. Das daraus resultierende konzeptionelle Modell soll sowohl Praktikern als auch Akademikern die unterschiedlichen Facetten von MC näher bringen und sie mit den wichtigsten Stellhebeln vertraut machen.
Literaturverzeichnis


de Bellis, E. et al. (2015a): The mass-customizing shopper: How narcissism drives consumers to configure unique products (im Reviewprozess).


Abb. 1: Beispiele von Mass Customization aus verschiedenen Industrien

Abb. 2: Konzeptionelles Modell von Mass Customization

Abb. 3: Die 3-K-Erfolgsfaktoren von Mass Customization

3-K-Erfolgsfaktoren von Mass Customization

Konsument
- Persönlichkeitscharakteristiken
  - Bedürfnis nach Einzigartigkeit
  - Gefühl der Überlegenheit
  - Narzissmus
- Vorherrschende, temporäre Zustände
- Einblick in eigene Präferenzen

Kontext
- Kulturelle Aspekte
  - Informationsverarbeitung
  - Unsicherheitsvermeidung
- Soziale Aspekte
  - Interaktion mit anderen Konsumenten
  - Geschenkconfiguration
- Situative Aspekte
  - Verwendetes Gerät

Konfigurator
- Konfigurationsformate
  - Sequenzielles vs. simultanes Format
  - Konfiguration mittels vorkonfig. Vorlagen
- Weitere Bausteine
  - Setzen von Defaults
  - Sperren einzigartiger Konfigurationen
  - Gamification
  - Info zu Marktanteilen

Quelle: Eigene Darstellung
Appendix 1: Zusammenfassung

- Mass Customization ist für viele Unternehmen bereits ein fester Bestandteil des Marketings. Trotzdem besteht unter Marketingmanagern Unklarheit über die zugrundeliegenden Mechanismen sowie die Stellhebel zur Optimierung des Kundenerlebnisses.


- Dieser Beitrag beleuchtet anhand aktueller Forschungsergebnisse diverse Erfolgsfaktoren von Mass Customization (die 3 K; Konsument, Kontext und Konfigurator) und leitet daraus akademische Forschungslücken sowie praxisnahe Handlungsempfehlungen ab.
Appendix 2: Kernthesen

- Die Persönlichkeit von Konsumenten (z.B. Narzissmus) wirkt sich direkt auf die Einzigartigkeit ihrer Konfiguration aus.
- Der kulturelle Kontext einer Konfiguration (z.B. Grad der Unsicherheitsvermeidung) bestimmt über Kauf oder Nicht-Kauf.
- Die Wahl des Konfigurationsformats (z.B. sequentielles Format) beeinflusst die Zahlungsbereitschaft von Konsumenten.
Appendix 3: Handlungsempfehlungen

- Die Möglichkeit, einzigartige Produkte zu kreieren, ist eines der Kernargumente für Mass Customization. Um dieses Potenzial auszuschöpfen, können Unternehmen die Option anbieten, die exakt gleiche Konfiguration sperren zu lassen.
- Der Grad an Unsicherheitsvermeidung bestimmt den Erfolg von Mass Customization. In Märkten mit hoher Unsicherheitsvermeidung sollten Online Assistenzyensysteme bereitgestellt werden, um die inhärente Unsicherheit von Kunden zu reduzieren.
- Das Design eines Konfigurators bietet viele Stellhebel zur Optimierung des Kundenerlebnisses. Der Einbau spielerischer Bausteine erhöht die Herausforderung und kann dadurch ökonomische Zielvariablen verbessern.
- Marketingmanager sollten die 3-K-Erfolgsfaktoren und ihre potenziellen Interaktionseffekte kennen, um von den vielseitigen Möglichkeiten von MC optimal Gebrauch machen zu können.
Article V


This research has been presented at the 2014 Society for Judgment and Decision Making (SJDM).
As Light Decreases, Speeding Increases

Emanuel de Bellis\textsuperscript{a}
Michael Schulte-Mecklenbeck\textsuperscript{b}
Wernher Brucks\textsuperscript{c}
Andreas Herrmann\textsuperscript{a}
Ralph Hertwig\textsuperscript{b}

\textsuperscript{a}Center for Customer Insight, University of St. Gallen, Switzerland
\textsuperscript{b}Max Planck Institute for Human Development, Germany
\textsuperscript{c}Traffic Division of the City of Zurich, Switzerland
Abstract

Worldwide, more than one million people die on the roads each year\textsuperscript{1}. One third of these fatal accidents are attributed to speeding, with properties of the individual driver and the environment regarded as key contributing factors\textsuperscript{1-3}. The quality of visual conditions has been shown to affect drivers’ speed perception, but the directionality of its effect on speeding is disputed. One set of findings suggests that drivers underestimate their speed when driving under adverse visual conditions (for example, in fog) and therefore accelerate\textsuperscript{4-8}; other research has observed a decrease in driving speed under such conditions\textsuperscript{9-12}. However, both sets of findings are based on driving simulations. Here we examine drivers’ real-world speeding behaviour and its interaction with illuminance, a ubiquitous environmental property defined as the luminous flux incident on a surface. Drawing on an analysis of 1.2 million vehicle movements, we show that reduced illuminance levels are associated with an increase in speeding. This relationship persists when we control for factors that are known to influence speeding (for example, fluctuations in traffic volume or time of day) and consider proxies of illuminance (for example, sight distance). Traffic planners can act on the inverse illuminance–speeding relationship by testing the extent to which improved street lighting can attenuate speeding and the associated accident rates. Our analysis illustrates one way of using big data to examine a hypothesized relationship that has been difficult to test conclusively in laboratory settings.
Main Body

In theory, every driver knows one of the key principles of road safety: If visual conditions are poor, reduce your speed. In practice, however, drivers appear not to slow down sufficiently to compensate for the higher risks associated with adverse visual conditions\textsuperscript{13,14}. Perception research suggests that drivers’ ability to recognize non-illuminated objects that demand a reduction in speed (for example, crossroads or pedestrians) is substantially diminished under low contrast, where the difference in brightness between an object and the background is reduced. Whereas ambient vision (which is of primary importance for guidance of locomotion) remains effective under low contrast, focal vision (which is responsible for visual recognition) is severely impaired\textsuperscript{15}. This perceptual account is complemented by the inferential nature of human perception. For instance, the perceived distance of an object is inferred from, among other cues, its contrast: the higher the contrast of an object, the closer it appears to be\textsuperscript{16}. Consequently, drivers operating under adverse visual conditions may not only take longer to recognize objects, but also overestimate their distance\textsuperscript{17}, as a result of which deceleration is delayed.

Insights from other lines of research suggest that drivers even speed up under adverse visual conditions. According to the Thompson effect, a classic principle in vision research, the perceived speed of moving objects is underestimated when contrast is reduced\textsuperscript{18-20}. Similar effects have been observed in functional imaging studies at lower levels of contrast, with results showing that these estimation biases arise in the earliest visual cortical regions\textsuperscript{21}. Do these findings generalize to actual driving? Snowden et al.\textsuperscript{4} showed that participants in computer-generated driving simulations not only perceived foggy (vs. clear) scenes to move more slowly, but also “drove” faster than a given target speed in simulated fog. This finding was replicated using filmed footage of actual traffic situations\textsuperscript{7,8}. However, these studies have
been criticized for representing a poor model of motion perception in three-dimensional environments, because contrast was reduced uniformly and independently of distance. Indeed, recent work employing more ecologically valid fog simulations\textsuperscript{10,11} or examining reduced levels of luminance\textsuperscript{12} (the amount of light emitted from a particular surface) has found that drivers overestimate their speed—an estimation bias that prompts them to decelerate.

One way to shed light on these contradictory findings is to step outside the laboratory and investigate the effects of visual conditions in real traffic\textsuperscript{22}. The only study to date to have analysed actual driving behaviour found a reduction in speed when contrast was reduced\textsuperscript{9}. However, this study was conducted on a closed road course, contrast was reduced uniformly, and the drivers’ view of the speedometer was obstructed. Thus, how light and speed interact “in the wild” is still unclear. We pursued a different approach: First, we asked which of the findings outlined above can be replicated in real traffic with all its distinctive environmental and driver-related factors, including other road users. Second, rather than investigating deviations from various target speeds (the standard measure in many experimental studies), we focused on drivers who exceeded the legal speed limit. Third, we extended research on contrast and luminance by investigating the effects of illuminance—defined as the luminous flux incident on a surface—a ubiquitous variable that policy makers are able to influence by environmental design (Extended Data Fig. 1).

The traffic division of the City of Zurich (Switzerland’s largest city) regularly uses hidden radar systems to measure vehicle speed for city planning purposes. Drivers are unaware of the measurement and are not prosecuted for speeding. Our analyses are based on the speed measurements of 1,220,359 vehicle movements, collected in 69 urban streets (Fig. 1) between 2007 and 2009. We calculated a speeding index by dividing the number of vehicles that exceeded the speed limit by the total number of vehicles per street and hour. To
examine the illuminance–speeding relationship, we then correlated the speeding index with hourly matched illuminance data (measured in lux and logarithmized) as well as with several proxies of illuminance, such as sight distance and fog (Methods and Extended Data Table 1).

Linear regression analyses that controlled for fluctuations in traffic volume yielded an inverse relationship between illuminance and the speeding index ($b = -1.241$, $P < 0.001$, partial $\eta^2 = 0.020$), indicating that a reduction in illuminance was associated with an increase in speeding behaviour. Specifically, a reduction in illuminance of 100 lux was associated with an increase in speeding of 0.59%. A cubic polynomial regression fitted the obtained pattern in Fig. 2 best, with a significant linear ($b = -586.4$, $P < 0.001$), quadratic ($b = 74.3$, $P < 0.001$), and cubic term ($b = -169.7$, $P < 0.001$). The cubic function explained significantly more variance than a quadratic function ($F = 57.734$, $P < 0.001$) and was not outperformed by a quartic function ($F = 0.600$, $P > 0.438$). The inverse illuminance–speeding relationship proved robust across less frequented and highly frequented streets (Extended Data Fig. 2), in 30 km/h and 50 km/h zones, on weekdays and at weekends, and across seasons (Table 1).

Although finding support for the inverse illuminance–speeding relationship during the day and at night (Table 1), the results presented in Fig. 2 indicate that the relationship may not be constant across the 24-hour cycle. In order to analyse this variability further, we calculated separate regression analyses for each hour of the day. The relationship proved to be constantly negative and significant for every hour between 8 am and 10 pm ($bs < -1.101$, $Ps < 0.05$), a period accounting for 84.4% of daily traffic volume, and negative but mostly non-significant at night (Extended Data Fig. 3). In addition, we considered the degree of speeding instead of using a dichotomous measure. Performing separate regression analyses for each speed bracket (for example, driving 31–35 km/h in a 30 km/h zone) showed that the
inverse relationship between illuminance and speeding was significant across speed brackets, but that its strength declined at higher levels of speeding (Fig. 3).

Examining proxies of illuminance provided converging evidence for the inverse illuminance–speeding relationship. Specifically, the relative proportion of speeding was higher when global irradiance was lower ($b = -4.093$, $P < 0.001$, partial $\eta^2 = 0.016$), when sunshine duration was shorter ($b = -0.069$, $P < 0.001$, partial $\eta^2 = 0.005$), when sight distance was shorter ($b = -0.087$, $P < 0.001$, partial $\eta^2 = 0.004$), and when particulate air pollution was higher ($b = 6.323$, $P < 0.001$, partial $\eta^2 = 0.005$). We also found speeding to be increased under foggy (vs. clear) conditions ($b = 7.068$, $P < 0.01$, partial $\eta^2 = 0.002$). As a control, we examined how precipitation—a condition in which drivers have been shown to slow down$^{13}$—impacts speeding. Speeding was indeed less pronounced when precipitation became stronger ($b = -0.161$, $P < 0.001$, partial $\eta^2 = 0.001$). In sum, various proxies of illuminance showed that, contrary to the ABCs of road safety, drivers showed more speeding behaviour in conditions of reduced illuminance.

The relationship between speeding and traffic accidents is well established$^{23}$; a speed reduction of only 5 km/h is generally estimated to yield a 15% decrease in accidents$^{14}$. Although the driver undoubtedly plays an important role$^{3}$, as it is he or she who puts the pedal to the metal, researchers have increasingly focused on environmental factors such as fog, contrast, and luminance, with driving simulation studies reporting mixed results$^{4,7,8,10-12}$. Having overcome the limitation of the Snowden et al. study (a focus on isolated perceptual mechanisms), our research confirms that illuminance is inversely related to drivers’ speeding behaviour in the real world. In line with our results, field research on accident prevention has shown that more natural light (as examined in the context of the change to and from daylight saving time$^{25,26}$) as well as more artificial light (as examined by manipulating the illuminance of street lighting$^{27,28}$) can result in fewer traffic accidents and fatalities. Our findings suggest
a mechanism underlying this illuminance–accident relationship: drivers’ increased tendency to speed when illuminance is reduced. Our analysis also demonstrates that risk taking (in terms of speeding), in addition to being a function of a person’s age or gender, is moderated by perceptual and environmental circumstances. More generally, we show that big data can be used not only for data mining and to explore unknown regularities, but also to provide real-world evidence of a hypothesized relationship that could not be tested conclusively in laboratory settings.

Notwithstanding the strengths of our approach, we acknowledge its limitations. The streets monitored in our dataset met planning and operational demands and hence do not represent a random sample of all Zurich streets. They are also urban; the degree to which an inverse illuminance–speeding relationship can be found at higher speeds (for example, on highways) remains an open question, especially in view of research suggesting that the Thompson effect may be attenuated in such conditions. Another limitation is that the location of illuminance measurement was not identical with the location of speed measurement, although differences in illuminance across measurement points were shown to be negligible (Methods). Also, although we found support for an inverse illuminance–speeding relationship across all speed brackets (Fig. 3), we cannot preclude the possibility that reduced illuminance is generally associated with more variance in speeding. Finally, we did not experimentally manipulate illuminance and thus cannot isolate the cause of its relationship with speeding. Does reduced illuminance increase speeding via impaired visibility of roadway elements, diminished distance perception, or the driver’s emotional state?

While the reported effects are subtle in statistical terms, they are potentially vital from a policy perspective because they play out across countless vehicle movements. They suggest at least two policy interventions that may reduce the frequency of speeding. One is education.
Drivers should be educated (for example, in driving schools) about the counterintuitive relationship between reduced illuminance and speeding behaviour—just as they are instructed in the effects of fatigue on reaction time. The other policy intervention is to pilot test the extent to which increasing illuminance (for example, by installing higher-intensity or illuminance-dependent street lighting) may reduce the likelihood of speeding and its potentially devastating consequences.
Methods

1. Speeding dataset

The traffic division of the City of Zurich regularly performs speed measurements throughout Zurich, Switzerland’s largest city, with a population of 400,000 and a daily movement of approximately 600,000 vehicles across the city borders\(^{31}\). The use of hidden radar systems means that drivers are unaware of the measurements, and they are not prosecuted for exceeding the speed limit. Over the study period, the radar systems were installed for on average 8 consecutive days (\(M = 7.7, SD = 4.2\)) per location and measured each passing vehicle’s driving speed around the clock.

Our analyses are based on the speed measurements of 1,220,359 vehicle movements, collected in 69 urban Zurich streets (Fig. 1) in both 30 km/h and 50 km/h zones between 31\(^{st}\) May 2007 and 24\(^{th}\) August 2009. The measurements are allotted to 5 km/h speed brackets for each hour. To analyse the illuminance–speeding relationship, we calculated a speeding index (SI) by dividing the number of vehicles exceeding the speed limit by the total number of vehicles (per street and hour), to give a scale ranging from 0 (no speeding) to 100 (all vehicles exceeded the speed limit):

\[
SI = \frac{N_{speeding}}{N_{total}} \times 100
\]

In line with local police regulations, speeding was defined as exceeding the speed limit by more than 5 km/h\(^{32}\). For instance, drivers in a 30 km/h zone were considered to speed if their driving speed was 36 km/h or higher (the same rule was applied to drivers in a 50 km/h zone, with a cut-off at 56 km/h). The illuminance–speeding relationship persisted when we used a hard speeding cut-off, considering speeds of 31 (51) km/h or faster in a 30 (50) km/h zone as speeding (\(b = -1.870, P < 0.001\) for 30 km/h zones and \(b = -1.349, P < 0.001\) for 50 km/h zones).

Three portable traffic counters were used to measure vehicle speed (manufacturer and share of reported measurements in brackets): (1) the KV Laser (Sodi Scientifica SpA; 25%), which is based on laser technology without external sensors, (2) the LOTOS system (CRVM; 33%), also based on laser technology, and (3) the Radar Traffic Recorder (RTR; Multanova AG; 42%), which is based on radar technology. Analysing the illuminance–speeding relationship separately for each system revealed slight variations in results, but the overall
picture was consistent: Illuminance was negatively related to speeding as measured by the KV Laser \((b = -1.591, P < 0.001)\), the LOTOS system \((b = -0.429, P < 0.001)\), and the RTR \((b = -1.119, P < 0.001)\). The use of different measurement systems reduces potential measuring errors and therefore speaks for the robustness of the results obtained.

In addition to the reported linear and polynomial regressions, we performed a linear mixed-effects analysis using the \textit{lme4} R package\(^{33}\) to account for the random effects structure of the dataset. As fixed effects, we entered illuminance and traffic volume (both logarithmized and without interaction term) into the model. As random effects, we entered an intercept for street as well as a by-street random slope for the effect of illuminance. The results substantiated the previously observed inverse illuminance–speeding relationship \((b = -0.235, SE = 0.092)\). A likelihood ratio test comparing the full model against a model excluding illuminance showed that this relationship reached statistical significance \(\chi^2 = 6.281, P < 0.05\).

2. Meteorological variables

Zurich covers an area of 91.9 km\(^2\), has a maximum north–south extension of 12.7 km, and a maximum east–west extension of 13.4 km\(^{34}\). Meteorological variables were measured either at Zurich downtown or at Zurich airport, approximately 8 km north of that (Extended Data Table 1). Local sunrise and sunset times were consulted to examine day/night differences.

To analyse the extent to which illuminance might differ across the speed measurement points, we ran two comparative analyses. First, we compared illuminance data from Zurich airport with those from an additional meteorological station situated approximately 1 km east of Zurich downtown (Zurich east). For the Zurich east station, data were available for about seven months (1\(^{st}\) January 2007 to 17\(^{th}\) July 2007). Correlating the illuminance measures from both stations for this timespan revealed a highly consistent pattern \((r = 0.984, P < 0.001)\), implying that fluctuations in illuminance across geographical locations within Zurich were negligible. Second, we used illuminance data from each station separately to analyse the inverse illuminance–speeding relationship. Using illuminance measures from Zurich east to predict the speeding index led to similar, but slightly stronger results than did using measures from Zurich airport; as in the overall analysis, reduced illuminance was associated with increased speeding \((b = -1.781, P < 0.001)\).
References


Figure 1 | Location and name of monitored streets across Zurich. The traffic division of the City of Zurich regularly uses hidden radar systems to measure the speed of passing vehicles for city planning purposes. Our analyses are based on the measured speed of 1,220,359 vehicle movements collected in 69 urban streets (see red dots) between 31st May 2007 and 24th August 2009.
Figure 2 | Overall relationship between illuminance and speeding. Illuminance represents the luminous flux incident on a surface per unit area averaged per hour and measured in log(lux). The speeding index indicates the number of vehicles exceeding the speed limit divided by the total number of vehicles, with 0 (100) implying that no vehicle (all vehicles) exceeded the speed limit. Each data point depicts a street at a given hour and represents 1 to 640 vehicles depending on traffic volume. Results show a negative relation between illuminance and speeding at low and high illuminance levels, but not at intermediate illuminance levels. Note that removing outliers (for example, data points with a speeding index of 0 and 100) or less frequented streets (for example, data points with a traffic volume of 5 and below) does not change the overall pattern of results.
Figure 3 | Illuminance–speeding relationship across speed brackets. For both 30 km/h and 50 km/h zones, we calculated separate regression analyses for each speed bracket. The y-axis indicates non-standardized regression coefficients and is reversed for ease of interpretation (that is, higher numbers indicate a stronger negative relationship). Across speed brackets, we found support for the inverse relationship between illuminance and speeding. However, the strength of the relationship declined with increasing speeding rates. All regression coefficients were significant at $P < 0.001$. 
### Table 1 | Robustness checks for the illuminance–speeding relationship.

<table>
<thead>
<tr>
<th></th>
<th>(a)</th>
<th>(b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>$-1.241^{**}$</td>
<td>$-0.854^{**}$</td>
</tr>
<tr>
<td></td>
<td>(0.052)</td>
<td>(0.048)</td>
</tr>
<tr>
<td>Less frequented streets (below median)</td>
<td>$-1.293^{**}$</td>
<td>$-1.191^{**}$</td>
</tr>
<tr>
<td></td>
<td>(0.078)</td>
<td>(0.076)</td>
</tr>
<tr>
<td>Highly frequented streets (above median)</td>
<td>$-1.172^{**}$</td>
<td>$-0.979^{**}$</td>
</tr>
<tr>
<td></td>
<td>(0.070)</td>
<td>(0.069)</td>
</tr>
<tr>
<td>30 km/h zone</td>
<td>$-1.538^{**}$</td>
<td>$-0.911^{**}$</td>
</tr>
<tr>
<td></td>
<td>(0.057)</td>
<td>(0.053)</td>
</tr>
<tr>
<td>50 km/h zone</td>
<td>$-0.689^{**}$</td>
<td>$-0.443^{**}$</td>
</tr>
<tr>
<td></td>
<td>(0.073)</td>
<td>(0.065)</td>
</tr>
<tr>
<td>Day (sunrise to sunset)</td>
<td>$-2.146^{**}$</td>
<td>$-1.991^{**}$</td>
</tr>
<tr>
<td></td>
<td>(0.292)</td>
<td>(0.294)</td>
</tr>
<tr>
<td>Night (sunset to sunrise)</td>
<td>$-1.639^{**}$</td>
<td>$-1.124^{**}$</td>
</tr>
<tr>
<td></td>
<td>(0.157)</td>
<td>(0.152)</td>
</tr>
<tr>
<td>Noon (12.00 to 12.59 pm)</td>
<td>$-4.697^{*}$</td>
<td>$-5.211^{*}$</td>
</tr>
<tr>
<td></td>
<td>(1.727)</td>
<td>(1.727)</td>
</tr>
<tr>
<td>Weekdays (Monday to Friday)</td>
<td>$-1.382^{**}$</td>
<td>$-0.947^{**}$</td>
</tr>
<tr>
<td></td>
<td>(0.064)</td>
<td>(0.058)</td>
</tr>
<tr>
<td>Weekends and statutory holidays</td>
<td>$-0.977^{**}$</td>
<td>$-0.654^{**}$</td>
</tr>
<tr>
<td></td>
<td>(0.088)</td>
<td>(0.084)</td>
</tr>
<tr>
<td>Spring (March to May)</td>
<td>$-1.249^{**}$</td>
<td>$-0.939^{**}$</td>
</tr>
<tr>
<td></td>
<td>(0.097)</td>
<td>(0.091)</td>
</tr>
<tr>
<td>Summer (June to August)</td>
<td>$-0.698^{**}$</td>
<td>$-0.639^{**}$</td>
</tr>
<tr>
<td></td>
<td>(0.079)</td>
<td>(0.066)</td>
</tr>
<tr>
<td>Autumn (September to November)</td>
<td>$-1.143^{**}$</td>
<td>$-0.555^{**}$</td>
</tr>
<tr>
<td></td>
<td>(0.100)</td>
<td>(0.095)</td>
</tr>
<tr>
<td>Winter (December to February)</td>
<td>$-0.923^{**}$</td>
<td>$-0.792^{**}$</td>
</tr>
<tr>
<td></td>
<td>(0.234)</td>
<td>(0.212)</td>
</tr>
</tbody>
</table>

Reported results are non-standardized regression coefficients of the illuminance–speeding relationship with standard errors in parentheses. **a**, The speeding index is regressed on illuminance and traffic volume (both logarithmized). **b**, The second model does not control for traffic volume. Significance levels: *$P < 0.01$, **$P < 0.001$ (linear regression models).
Extended Data Figure 1 | Illuminance over a 24-hour period and across seasons.
We calculated the average illuminance for each hour of the day in Zurich for the observational time period between 2007 and 2009 split into four seasons. Time of day corresponds to the local time (UTC+1 adjusted for daylight saving time). The figure shows the mean daily fluctuations in illuminance, from minimal illuminance values in the early morning hours to maximum illuminance shortly after noon. Seasonal changes in illuminance are apparent in the earlier increase in illuminance in the morning (summer < spring < autumn < winter) and the later decrease in illuminance in the evening (summer > spring > autumn > winter).
Extended Data Figure 2 | Illuminance–speeding relationship by traffic volume.

This figure depicts the relationship between illuminance and speeding as in Fig. 2, but is split by the traffic volume of the respective street per hour. We chose four brackets, each containing a similar number of measurement points: 1–5 vehicles per hour (6497 measurement points), 6–18 (6917), 19–55 (7012), and 56–640 (7147). The fitted line shows some variation across the four panels, but they all point to an inverse illuminance–speeding relationship.
Extended Data Figure 3 | Illuminance–speeding relationship by time of day. We calculated separate regression analyses for each hour of the day. The y-axis indicates non-standardized regression coefficients and is reversed for ease of interpretation (that is, higher numbers indicate a stronger negative relationship). Time of day corresponds to the local time (UTC+1 adjusted for daylight saving time). The illuminance–speeding relationship was particularly strong after noon and was (with one exception) non-significant at night, when traffic volume reaches its daily minimum.
## Extended Data Table 1 | Variable transformations and sources.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Aggregation/ Transformation</th>
<th>Unit</th>
<th>Location</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic volume</td>
<td>Total number of passing vehicles per street and hour</td>
<td>Summed per hour and logarithmized</td>
<td>Number of vehicles</td>
<td>69 streets in Zurich</td>
<td>Traffic division of the City of Zurich, Switzerland</td>
</tr>
<tr>
<td>Speed</td>
<td>Speed of passing vehicles per street and hour</td>
<td>Summed per hour and measured in 5 km/h speed brackets</td>
<td>km/h</td>
<td>69 streets in Zurich</td>
<td>Traffic division of the City of Zurich, Switzerland</td>
</tr>
<tr>
<td>Speeding index</td>
<td>Proportion of vehicles exceeding the speed limit per street and hour (based on speed variable)</td>
<td>N(speeding) / N(total) × 100</td>
<td>% of measured vehicles</td>
<td>69 streets in Zurich</td>
<td>Traffic division of the City of Zurich, Switzerland</td>
</tr>
<tr>
<td>Illuminance</td>
<td>Luminous flux incident on a surface per unit area</td>
<td>Averaged per hour and logarithmized</td>
<td>lx</td>
<td>Zurich airport / Zurich east</td>
<td>Swiss Federal Office of Meteorology and Climatology</td>
</tr>
<tr>
<td>Global irradiance</td>
<td>Electromagnetic radiation</td>
<td>Averaged per hour and logarithmized</td>
<td>W/m²</td>
<td>Zurich airport</td>
<td>Swiss Federal Office of Meteorology and Climatology</td>
</tr>
<tr>
<td>Sunshine duration</td>
<td>Cumulative time of direct irradiance from the sun (&gt; 120 W/m²)</td>
<td>Summed per hour</td>
<td>min</td>
<td>Zurich airport</td>
<td>Swiss Federal Office of Meteorology and Climatology</td>
</tr>
<tr>
<td>Sight distance</td>
<td>Maximal horizontal distance at which an object or light source can be clearly discerned</td>
<td>None (measured at 3-hour intervals)</td>
<td>km</td>
<td>Zurich airport</td>
<td>Swiss Federal Office of Meteorology and Climatology</td>
</tr>
<tr>
<td>Particulate air pollution</td>
<td>Microscopic solid or liquid matter</td>
<td>Averaged per hour and logarithmized</td>
<td>µg/m³</td>
<td>Zurich downtown</td>
<td>Swiss Federal Office for the Environment</td>
</tr>
<tr>
<td>Fog</td>
<td>Low-lying clouds</td>
<td>None (measured at 3-hour intervals)</td>
<td>Binary (present/absent)</td>
<td>Zurich airport</td>
<td>Swiss Federal Office of Meteorology and Climatology</td>
</tr>
<tr>
<td>Precipitation</td>
<td>Condensation of atmospheric water vapour</td>
<td>Summed per hour and logarithmized</td>
<td>mm</td>
<td>Zurich airport</td>
<td>Swiss Federal Office of Meteorology and Climatology</td>
</tr>
</tbody>
</table>
Curriculum Vitae

Personal information
Name Emanuel de Bellis
Date of birth December 20, 1985
Place of birth Basel

Education
2011–2015 University of St. Gallen
Doctoral studies in Management
2009–2011 University of Basel
Master studies in Cognitive and Decision Sciences
2005–2008 University of Basel
Bachelor studies in Psychology (Minor: Business Administration)
1999–2004 Gymnasium Kirschgarten, Basel
Matura with focus on Physics and Applied Mathematics

Work experience
2011–2015 Center for Customer Insight, University of St. Gallen
Research associate in Marketing and Consumer Behavior
2010 Consumer Science Group, Nestlé Research Center, Lausanne
Research internship
2008–2009 LP Marktforschung, Basel
Internship & part time employee