

# Shopping experiences in visually complex environments: a self-regulation account

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## Abstract

**Purpose** – Providing satisfying shopping experiences is a major goal in retail management because satisfaction guides re-patronage behavior. The purpose of this paper is to demonstrate that the visual complexity of an environment's interior design (i.e. the overall amount of visual information in an environment) influences the shopping experience by impairing customers' information processing and self-regulation resources.

**Design/methodology/approach** – Two quasi-experimental field studies were conducted in two different cultural contexts (i.e. Germany and Singapore) to enhance the external validity and robustness of the findings.

**Findings** – Both studies provide evidence that an environment's visual complexity impairs the shopping experience. Study 1 shows that visual complexity places a perceptual load on customers which mediates the complexity-experience relationship. Study 2 replicates this finding in a different setting and extends it by showing that load relates to lower self-control, which in turn, mars the experience. Furthermore, the negative effect of complexity on the experience is more pronounced with shoppers pursuing utilitarian rather than hedonic shopping goals.

**Research limitations/implications** – The findings in a supermarket context may not transfer to environments in which the visual design is an important component of the value proposition and where shopping goals are largely hedonic in nature.

**Practical implications** – The findings advance theory by showing that it is perceptual load and its outcome, reduced perceived self-control, which are largely responsible for the negative effect of visual complexity on the shopping experience. This finding should encourage managers to proactively manage and reduce the complexity of their service environments.

**Originality/value** – This study is the first to show how the visual complexity of a retail environment influences a customer's shopping experience. It offers novel insights into the underlying mechanism of perceptual load and self-control as process mediators of visual complexity on the shopping experience.

**Keywords** Satisfaction, Environment, Consumer psychology, Visual perception

**Paper type** Research paper

## Introduction

According to the Food Marketing Institute (FMI), consumers spent more than 600 billion dollars in US supermarkets in 2013, accounting for almost 6 percent of their total disposable income. The average supermarket now carries over 43,000 items in just under

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47,000 square feet of space and the average customer visits a store just under twice a week (FMI, 2014). While those numbers change with supermarkets in Europe (PlanetRetail, 2014) and Asia (DPI, 2009), retailers across the globe constantly face challenges including new formats (e.g. e-tailing), an increasing demand for convenience, a shift toward freshness, and a constant struggle to balance store vs national brand listings. Before this background, the goal of this paper is to examine how interior design (i.e. overall visual complexity) can provide a competitive edge by enhancing the experience customers have in a store.

Providing pleasurable, satisfying, or even delightful shopping experiences is a major goal in retailing (Verhoef *et al.*, 2009), because satisfaction influences future behavior (Arnold *et al.*, 2005; Mattila and Wirtz, 2000). Even for frequently recurring and seemingly mundane grocery shopping tasks, retailers aim to devise pleasurable and sometimes also entertaining shopping experiences (Esbjerg *et al.*, 2012). Among the tools for enhancing shopping experiences (see Bitner, 1992; Lovelock and Wirtz, 2011 for an overview) are the visual design of the exterior (Nasar, 1994), the interior shell (floors, ceilings, and walls) and its content (furniture, shelves, displays; Orth *et al.*, 2012), the layout of the floor space (Dagger and Danaher, 2014), greenery (Bregman *et al.*, 2012), ambient conditions such as music and scents (Mattila and Wirtz, 2001), and the variety and size of assortments presented (Oppewal and Koelemeijer, 2005). Especially the visual design of retail environments is an increasingly employed tool for enhancing the shopping experience (Ortinou *et al.*, 2013), because visual design can be conveniently tailored to generate desirable responses such as evoking arousal and pleasure (Van Rompay *et al.*, 2012), triggering approach behaviors (Ballantine *et al.*, 2010), and supporting store positioning (Baker *et al.*, 1994).

Beyond interior design, retailers use additional means to engineer the customer experience, but many of these means can also impact the environment's visual complexity. Consistent with research on visual perception in general (Stamps, 2004) and perception of interior environments in particular (Oliva *et al.*, 2004), we define visual complexity as the overall visual diversity or amount of information (entropy) contained in a scene, a close correlate of the degree of difficulty one encounters in providing a verbal description of that scene.

Visual complexity is determined by a wide range of dimensions and stimuli, many of which are relevant in service environments. For example, visual complexity increases with increasing quantity (Wolfe *et al.*, 2005) and range (Pieters *et al.*, 2007) of objects, and the variety of assortments presented (Hoch *et al.*, 1999). Visual complexity also increases with reduced regularities, such as symmetry, repetition, and similarity (Oliva and Torralba, 2001), and the degree of perceptual grouping of objects in a visual field (Palmer, 1999). Furthermore, the perceived complexity of an environment increases with higher variations in color, contrast, and patterns of materials and surface textures (Heaps and Handel, 1999; Leder and Carbon, 2005).

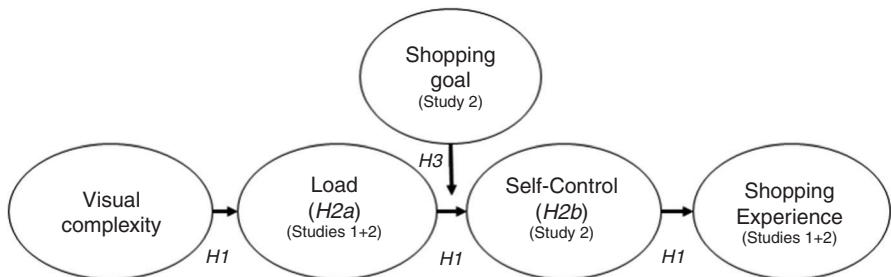
Visual complexity influences people's processing of abstract figures (Reber *et al.*, 1998), consumer products (e.g. Cho and Schwarz, 2010), and packages (Orth and Malkewitz, 2012). However, except for Orth and Wirtz's (2014) study (which focusses on the visual appeal of servicescapes), little is known on the effects of visual complexity in retail environments. The present work extends their research and suggests that low-complexity interiors relate to more positive shopping experiences because they place a lower cognitive load on customers' mental resources and require less self-control for customers to attain their shopping goals.

Research on consumer self-regulation in general (Muraven and Baumeister, 2000), and retail environments in particular (Mattila and Wirtz, 2008), indicate that placing a

cognitive load on people impairs their deliberate, careful decision making, thus possibly influences how they experience a shopping trip. Studies on service interiors suggest that visitors process complex environments slower and with greater difficulty (Orth and Wirtz, 2014). In other contexts, visual complexity interferes with attention to target objects (Lu and Itti, 2005), hinders visual search (Rayner, 2009), and slows down stimulus processing (Clement *et al.*, 2013). More demanding processing places a cognitive load on people’s mental resources (Schwarz, 2004). Despite findings that visual complexity can negatively impact viewer processing outcomes of exterior facades (Akalin *et al.*, 2009), artifacts (Taylor *et al.*, 2005), living environments (Joye, 2007), and interiors (Nadal *et al.*, 2010), products (Creusen *et al.*, 2010), packages (Orth and Malkewitz, 2012), and websites (Geissler *et al.*, 2006), a significant gap remains in the understanding of how consumers respond to visually complex service environments, which is the focus of the present study.

This study contributes to theory by extending Orth and Wirtz’s (2014) research. In particular, the present study helps to determine the specific workings of visual complexity and shows how they apply to service environments. The core contribution of Orth and Wirtz (2014) is to establish effects of visual complexity on approach/avoidance behavior through processing fluency and perceived attractiveness of an environment. The authors proffered that the observed effects in their study occur because complexity increases perceptual load and depletes resources, but the authors did not test this prediction. The current study aims at establishing the implied role of perceptual load and the mediated relationship via complexity. In other words, Orth and Wirtz (2014) show that complexity effects process fluency, which then affects response behaviors. The present study digs deeper and establishes that it is indeed perceptual load and subsequently reduced perceived self-control that are responsible for the lower level of process fluency. Furthermore, this study is the first to explore shopping motivation as a moderator of the complexity-shopping experience relationship and shows that a utilitarian shopping motivation further increases the negative effects of load on experience. Figure 1 shows the conceptual framework and its operationalization in two empirical studies.

The secondary contributions of this study are to extend Orth and Wirtz’s (2014) base model by examining post-shopping experience satisfaction (rather than pre-experience consumer decision making to enter and continue rather than turning around and exiting an environment), and retesting the base model in a different shopping context (more utilitarian rather than hedonic), cultural setting (Germany and Singapore, rather than just Singapore), and method (quasi-experimental studies rather than



**Note:** Hypotheses numbers in brackets denote a mediating relationship

**Figure 1.**  
Conceptual  
framework and  
hypotheses

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experimental study cum survey) to build confidence in the robustness, external validity, and wider applicability of the role of visual complexity in consumer responses to service environments.

### **Conceptual framework and hypotheses development**

#### *Visual complexity of service environments and processing load*

The main line of argument of this study is that the visual complexity of a service environment increases load and hereby mars the shopping experience. This prediction is rooted in studies on load and self-regulation. Specifically, research on metacognition showed that a stimulus' visual complexity relates to more effortful processing (Reber *et al.*, 2004), thus implying a greater load placed on viewers. Service research reports that visual complexity of a scene hinders processing of the environment (Orth and Wirtz, 2014), and of items presented in this environment (Orth and Crouch, 2014). While simplified assortment displays on e-tailing websites make it easier for shoppers to focus on an item (Huang and Kuo, 2011), visually crowded shelf displays disrupt shopper attention and slow down processing (Clement *et al.*, 2013). Together, these studies suggest that visual complexity of an environment relates to higher load.

Furthermore, according to the Preference Framework (Kaplan *et al.*, 1998), people seek to fulfill two basic needs when faced with a new environment: to understand and to explore. An environment's complexity can hinder immediate exploration (Stamps, 2004) and again increase load. Applications of the framework suggest a detrimental effect of visual complexity on people experiencing natural environments (Kaplan *et al.*, 1998), urban scenes (Nasar *et al.*, 2005), servicescapes (Yildirim *et al.*, 2007), websites (Rosen and Purinton, 2004), and online shopping environments (Demangeot and Broderick, 2010).

#### *Processing load and self-control capacity*

The ability to focus on goal-relevant stimuli in the presence of potentially interfering distractors is crucial for people's executive functioning (Lavie, 2005). In a retail context, an environment's visual complexity may represent goal-irrelevant stimuli that distract from the shopping task, preventing processing of goal-relevant information such as identifying items and navigating through the store. Goal-relevant processing depends critically on the load involved in the processing of distractor information (Lavie *et al.*, 2004). Specifically, high load (i.e. a large amount of distractor information) can eliminate or at least attenuate goal-relevant processing, whereas low load on cognitive processing resources increases goal-relevant processing (Lavie, 2005).

Accommodating both behavioral and neuroimaging evidence, the load theory of attention and cognitive control posits that load depletes temporarily a person's self-regulation capacity (Lavie, 2000). Specifically, metacognition research suggests that individuals monitor their thoughts and the mental effort required for processing input, and try to gain some control over them (Schwartz *et al.*, 2013). According to the resource model of self-control (Baumeister *et al.*, 1994), the ability to self-regulate draws on a limited inner resource which is temporarily depleted through acts of self-control. Self-regulation is the attempt to control or alter one's own responses, and there are numerous indications that self-regulation is an effortful process (Muraven *et al.*, 1998). Note that, consistent with Baumeister and Vohs (2007), this paper uses the terms self-regulation and self-control interchangeably (although self-control sometimes is considered to be only the conscious subset of self-regulation processes).

People's capacity for self-regulation is limited (Baumeister, 2002), and deliberate attempts at self-control reduce performance on other tasks that are being performed

subsequently (Muraven *et al.*, 1998). For example, individuals who actively tried to control their visual attention and ignore meaningless, irrelevant stimuli performed worse on a subsequent task than participants who viewed the same meaningless stimuli but did not actively try to ignore them (Gilbert *et al.*, 1988). Overall, resource depletion research agrees that effort fully controlling oneself consumes a limited resource and reduces the amount of this resource available for other tasks, resulting in poorer performance on these tasks (Muraven *et al.*, 2006). Thus, in the example of visual load due to an environment's complexity, a person exerts more self-control to focus on carrying out a shopping task, which in turn is proposed to have negative consequences for their evaluation of the overall shopping experience. In contrast, individuals who exert less self-control are more likely to have a positive experience and feel higher levels of satisfaction (Eun *et al.*, 2013).

This prediction receives further support from reports that being depleted of self-regulatory resources robs people of making rational deliberate decisions in pursuit of their goals (Hamilton *et al.*, 2007). Resource depletion thus has negative consequences for consumer behavior in general (Wang *et al.*, 2010) and buying decisions in particular (Vohs and Faber, 2007).

Synthesizing the literature on load and self-control suggests that enhanced self-regulating in a visually complex shopping environment will take more away from the resource, leaving the shopper that much more depleted afterwards. The outcome of this process is expected to result in a poorer evaluation of the shopping experience, leading to the following hypotheses:

- H1. A shopping environment high in visual complexity will generate a less positive shopping experience than an environment low in complexity.
- H2. The negative effect of complexity on shopping experience will be mediated by (a) perceptual load, and (b) its outcome, reduced perceived self-control.

#### *Hedonic vs utilitarian shopping goals*

Consumers' shopping goals should moderate the impact of perceptual load on their shopping experience. Consumers enter stores with specific goals in mind, and these goals can be arranged along a continuum ranging from the hedonic to the utilitarian (Babin *et al.*, 1994). Hedonic goals focus on the shopping experience itself with the objective of experiencing positive affect (e.g. shopping with friends to socialize, explore, and have fun). Conversely, utilitarian goals are predominantly instrumental or functional in nature (e.g. weekly grocery shopping).

Anything that hinders the goal attainment of task-oriented shoppers is likely to cause negative responses (Babin *et al.*, 1994). A few studies have identified consumer motives as key drivers of the differential responses to ambient dimensions (Wirtz *et al.*, 2000, 2007) and visual aspects of service environments (e.g. Bloch *et al.*, 1994). For example, Haytko and Baker (2004) suggest that adolescent girls' hedonic shopping motivation enhances the relationship between perceived visual aspects (atmosphere) of mall interiors and the experience. In utilitarian settings, however, cognitive effort is required when choosing a product (Mattila and Wirtz, 2008). Thus, an environment that is too complex would be more likely to interfere with and hinder goal attainment than it would in a hedonic shopping situation. Therefore:

- H3. The motivation in a specific shopping situation will moderate the effect of perceptual load on the shopping experience. Specifically, the negative effects of perceptual load on shopping experience will be stronger when consumers pursue utilitarian rather than hedonic shopping goals.

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## Overview of method considerations

### *Focus on holistic perception of environments*

Past studies on store atmospheric effects have mostly adopted an elemental perspective by focussing on the impact of one or a few store visual cues on consumer response (e.g. Ballantine *et al.*, 2010). Research on natural environments has long established that adopting a holistic perspective yields superior explanations for human behavior related to visual aspects than focussing on individual elements (Stamps, 2004). Bitner (1992) was one of the first to suggest a holistic perspective on servicescapes.

While Bitner's (1992) framework has shaped many retailing studies (e.g. Turley and Milliman, 2000; Williams and Dargel, 2004), those studies still focus on only one or a few elements of visual design such as color or spatial layout. Notable exceptions are Demangeot and Broderick's (2010) gestalt approach to online shopping environments, and Zomerdijk and Voss's (2010) findings that design professionals suggest an experience-centric approach to designing service environments. In summary, holistic approaches to retail environments appear underdeveloped, and we therefore focus on visual complexity as a holistic impression in this study.

### *Individual field dependence-independence*

Research has often operationalized people's perceptual style on a continuum of field independence/dependence (for a review, see Zhang, 2004). Field dependence captures the degree to which perception is dependent on the prevalent structure of a visual field (Witkin, 1950). People who are more field-dependent experience difficulties in perceiving a part as existing separately from the complex whole in which it is embedded (Goodenough, 1987). Thus, they find it also more difficult to discriminate between relevant and irrelevant information cues (Arthur and Day, 1991). In contrast, people who are more field-independent have greater cognitive disembedding skills and encounter fewer problems in discriminating relevant from irrelevant information (Goodenough, 1987).

Field dependence varies across people, but additionally across a person's life span (Panek, 1985) and across cultures (Kitayama *et al.*, 2003). Cross-sectional studies suggest that people exhibit an accelerating rate of field dependence after they reach their late 30s (Eisner, 1972). Individual field dependence is also susceptible to cultural influences with East Asians exhibiting greater field dependence than do people in Western cultures (Nisbett and Miyamoto, 2005). Given that field dependence captures the relative influence of a visual field (Witkin, 1950), field dependence may affect the load people acquire from a scene (Matthes *et al.*, 2011; Orth and Wirtz, 2014). For these reasons, field dependence serves as a control variable in our empirical studies.

### *Quasi-experimental design across two cultural settings*

Two quasi-experimental field studies were conducted in two different cultural contexts (i.e. Germany and Singapore). This approach was chosen to enhance the robustness of the findings, and to build confidence in the external validity and wider applicability of the role of visual complexity in consumer responses to service environments. It also complements past research by Orth and Wirtz (2014) that used an experimental cum survey approach.

While quasi-experiments have the drawback that not all potential confounds can be ruled out, they are an acknowledged method in customer research in general (Evans *et al.*, 2000) and studies on servicescapes in particular (Parish *et al.*, 2008). To minimize potentially confounding effects within each store, we controlled for respondent-specific variables (e.g. age, gender, and frequency of visits; none of these

variables was significant), and we randomized out within store factors such as crowding, weather, day of week, and other externalities through using a randomized time roster for the data collection. Across stores, we controlled for key variables by selecting comparable shops, plus we entered “shop” as a control variable in our analysis to control for any potential shop-specific variance that might explain our dependent variables.

Finally, because different cultures have varying tolerance for complexity (Henderson *et al.*, 2003) and vary in field dependence (Kitayama *et al.*, 2003), we selected two different cultural settings. That is, Germany as a Western culture can be considered low in field dependence, whereas Singapore as an Eastern culture is high in field dependence, thereby offering ideal contexts for a robust testing of our hypotheses.

Study 1 tested the hypothesized negative effect of context complexity on shopping experience (*H1*) and the mediating role of load (*H2a*). Study 2 replicated Study 1 (*H1*, *H2a*) in a different cultural context, and extended Study 1 by adding self-control (*H2b*) and shopping goals (*H3*).

### Study 1: retail chain setting in Germany

Study 1 was set in the Edeka chain in Hamburg, Germany. Being Germany’s largest retailer of groceries, Edeka is a franchise with a large number of independent owner-operators. As a consequence, there is substantial variance across stores not only in size, but also in interior design and layout.

#### Pretests

The researchers took pictures of a large number of Edeka stores which were selected to differ in visual complexity, but not in other critical characteristics such as store size, assortment, price level, or type of location. These pictures were presented electronically in a standardized mode to five professionals in the field of visual design and architecture. The photos were shown in sequential order to show what customers would experience when walking through the store (see Plates A1-A4 for illustrative examples). The experts then rated the stores on visual complexity using Pieters *et al.* (2010) scale. Based on an index computed by averaging a store’s rating on complexity, one high-scoring store ( $M = 5.9$ ) and one low-scoring store ( $M = 3.6$ ) were selected for the main study.

#### Method of main study

In the main study interviewers randomly intercepted every fifth shopper after check-out and invited them to complete a paper-and-pencil survey. The final sample consisted of 150 respondents (66 percent female, an average age of 47.3 years) evenly distributed across both stores. Furthermore, the times of the day and days of the week were standardized across both stores to cover both busy and less busy periods in about equal numbers, and to randomize out potential effects of crowding and other potential covariates of peak and off peak hours, and weekday and weekend shopping. Screening questions confirmed that respondents were actual shoppers, and lived in the catchment area of this supermarket.

Constructs were assessed using standard measures taken from the literature (see Table A1). Respondents first rated their shopping experience (Wirtz and Lee, 2003;  $\alpha = 0.77$ ,  $M = 4.91$ ,  $SD = 0.83$ ), our main dependent variable, to avoid any potential demand effects caused by the measurement of the independent and mediating variables. Next, perceptual load (Wirth *et al.*, 2009;  $\alpha = 0.72$ ,  $M = 2.13$ ,  $SD = 0.90$ ), field dependence (Choi *et al.*, 2007;  $\alpha = 0.90$ ,  $M = 4.71$ ,  $SD = 1.27$ ), and visual complexity of

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the interior (Pieters *et al.*, 2010;  $\alpha = 0.76$ ,  $M = 3.99$ ,  $SD = 0.95$ ) were measured. The final questions focussed on respondent age, gender, and frequency of visits to this store.

Table AI holds the summary statistics for all measures. Our measurement model does not lend itself to structural equation modeling because, consistent with our research goals and previous research, it uses reflective indicators rather than formative ones (see Jarvis *et al.*, 2003). We therefore used traditional statistics to assess measurement quality. Specifically, discriminant validity was examined by reviewing the validity diagonals (correlation coefficients; Table AII). All are significantly different from zero but relatively small, suggesting that different yet related constructs are being measured by each of the scales, as intended. The measures showed good Cronbach's  $\alpha$  values of 0.73 and higher, and all individual items of a construct correlated higher with each other than with items from other constructs, which together indicate convergent validity. Confirmatory factor analysis conducted with AMOS22 indicated a good fit of the model ( $\chi^2 = 350.244$ ,  $df = 218$ ,  $p < 0.01$ ,  $df = 1.607$ ,  $CFI = 0.903$ ,  $IFI = 0.906$ ,  $SRMR = 0.074$ ) and a much stronger test of the reliability and validity of the constructs. As we will show later in the analysis, our study replicates Orth and Wirtz's (2014) base model, suggesting nomological validity of the constructs involved.

### *Analysis and findings*

Running Analysis of Variance indicated a significant main effect of the store on perceived complexity ( $F(1,148) = 33.1$ ,  $p = 0.001$ ), with the treatment selected to represent a visually more complex store resulting in a significantly higher score than the one selected for lower complexity ( $M = 4.3$  vs  $M = 3.4$ ). We take these findings as evidence that our selection of two stores generated sufficient variance in visual complexity. Furthermore, none of the main and interaction effects of the control variables (age, gender, shopping frequency) reached significance at  $p < 0.05$  with our independent and mediating variables and were therefore dropped from our final models.

As our main contribution rests with testing mediation effects, we employed an SPSS macro that allowed bootstrapping analysis which is generally seen as the most appropriate method for our type of data set (Hayes, 2012). The results indicate that the indirect effect of complexity on shopping experience (through perceptual load) was insignificant. Supporting *H1*, complexity had a significant negative effect on the shopping experience ( $B = -0.14$ ,  $t = -2.05$ ,  $p = 0.042$ ). Further, complexity had a significant effect on load ( $B = 0.25$ ,  $t = 3.08$ ,  $p = 0.002$ ), which, in turn, had a negative effect on shopping experience, when controlling for complexity ( $B = -0.18$ ,  $t = -2.68$ ,  $p = 0.008$ ). When controlling for load, the effect of complexity on shopping experience was non-significant ( $B = -0.09$ ,  $t = -1.36$ ,  $p = 0.17$ ), indicating full mediation. Supporting *H2a*, bootstrap results indicated that the 95 percent Confidence Interval (CI) around the indirect effect did not contain zero (simple slope =  $-0.05$ ;  $LLCI = -0.10$ ,  $ULCI = -0.01$ ), and the Sobel test (assuming normal distribution) was also significant ( $z = -1.96$ ,  $p = 0.049$ ).

Testing for a possible effect of field dependence involved following the procedure prescribed by Frazier *et al.* (2004). To control for Type I errors, all the moderator effects (i.e. interactions) entered in a single (second) step after entering the predictor (effects-coded) and moderator variables on which they are based (i.e. the main effects) in the previous (first) step (Zhao *et al.*, 2010). Using the significance of the omnibus *F*-test representing the variance explained by this entire step, yielded whether it should be eliminated from the model (if the omnibus test is not significant) or whether *t*-tests representing specific moderator effects should be inspected for statistical significance (Aiken and West, 1991). The results show a significant effect of complexity on load



( $B = 0.25$ ,  $t = 3.20$ ,  $p = 0.002$ ), a non-significant direct effect of field dependence ( $B = -0.02$ ,  $t = -0.32$ ,  $p = 0.75$ ) and a non-significant interaction effect of complexity and field dependence ( $B = 0.02$ ,  $t = 1.72$ ,  $p = 0.09$ ).

To further explore potential confounding effects introduced by store, we added “store” as a control variable to our analysis. That is, any potential store-specific confounding effect would absorb the variance that was explained by complexity perceptions in our model. The findings showed that the  $B$  coefficients of complexity’s influence on load remain significant and unchanged ( $B = 0.25$ ,  $t = 3.19$ ,  $p = 0.002$ ). The store dummy variable proved not to be significant ( $p = 0.55$ ), and therefore did not affect the relationships of the other key variables in our theoretical model. In other words, unobserved store-specific variables do not provide rival explanations for our findings.

In summary, Study 1 provides initial evidence for the detrimental effect of a retail environment’s visual complexity on shoppers’ experiences. Specifically, visually more complex environments reduce the shopping experience with load mediating the effect. Individual field dependence did not affect the complexity-load relationship.

### Study 2: retail chain setting in Singapore

The findings of Study 1 are important and significant, but could be limited by the context (i.e. Edeka supermarkets and a German cultural setting), and the study’s lack of a direct measure of self-regulation. The second study aimed to mitigate these concerns by being seated in an Eastern context (i.e. Singapore) where there is a higher level of field dependence compared to Germany (Allinson and Hayes, 2000). Furthermore, replicating the study in a different cultural context and retail shopping environment enhances the robustness of findings by minimizing potential covariates. Finally, Study 2 added an established measure of perceived self-control to allow testing for  $H2b$ .

Data were obtained from customers of two supermarkets of the Shang Siong chain in Singapore. While supermarkets account for a major share of grocery retailing in Germany, the format covers a much smaller percentage in Singapore where traditional small food stores and wet markets still are prominent (USDA, 2012). As such, the setting of Study 2 offers a robust context for (re)testing our hypotheses.

### Method

Study 2 employed an approach identical to the one used in Study 1. Two stores of the Shang Siong chain were selected from a pool of possible outlets based on professional feedback, one scoring high ( $M = 4.7$ ) and the other low ( $M = 3.0$ ) on interior visual complexity. Interviewers randomly intercepted 133 consumers (67 percent female, average age of 32.3 years; 67 visitors to one store and 66 to the other) equally distributed among both stores during different times of the day and days of the week. The interviews in Singapore were conducted in the same extended periods, where we randomized the shops to be interviewed (i.e. we always interviewed one shop at a time), and where we implemented the same control measures as in Study 1. This approach allowed randomizing out potential confounding effects related to shoppers, time, and stores.

A paper-and-pencil survey captured responses. A screening question confirmed that respondents had purchased at least one item in the store before they proceeded to rate their shopping experience (Wirtz and Lee, 2003;  $\alpha = 0.87$ ,  $M = 4.39$ ,  $SD = 1.12$ ), field dependence (Choi *et al.*, 2007;  $\alpha = 0.87$ ,  $M = 5.06$ ,  $SD = 1.04$ ), shopping motivation (Babin *et al.*, 1994;  $\alpha = 0.73$ ,  $M = 4.22$ ,  $SD = 1.57$ ), and the visual complexity of the interior (Pieters *et al.*, 2010;  $\alpha = 0.73$ ,  $M = 3.86$ ,  $SD = 0.80$ ). Differing from Study 1, the questionnaire included the original and slightly shorter measure of perceptual load

(Paas *et al.*, 2003;  $\alpha = 0.81$ ,  $M = 3.48$ ,  $SD = 1.02$ ) and an additional scale on perceived self-control (Tangney *et al.*, 2004;  $\alpha = 0.88$ ,  $M = 4.03$ ,  $SD = 0.91$ ) to directly test the proposition that load depletes self-control. Both scales held slightly modified items to fit the retail context. The final section captured the respondents' age and gender, and frequency of visits to this store. As with Study 1, confirmatory factor analysis (using AMOS22) indicated a good fit of the model ( $\chi^2 = 1,286.109$ ,  $df = 849$ ,  $p < 0.01$ ,  $df = 1.515$ ,  $CFI = 0.889$ ,  $IFI = 0.891$ ,  $SRMR = 0.081$ ) and more a robust tests of the scales comprising the constructs.

### *Analysis and findings*

Mediation analysis showed that complexity had a significant negative effect on the shopping experience ( $B = -0.22$ ,  $t = -2.24$ ,  $p = 0.026$ ), supporting *H1*. Further, complexity had a significant effect on load ( $B = 0.26$ ,  $t = 2.88$ ,  $p = 0.004$ ), which, in turn, had a negative effect on shopping experience when controlling for complexity ( $B = -0.27$ ,  $t = -3.46$ ,  $p = 0.001$ ). When controlling for load the effect of complexity on shopping experience was insignificant ( $B = -0.15$ ,  $t = -1.54$ ,  $p = 0.12$ ), indicating full mediation. Supporting *H2a*, bootstrap results indicated that the 95 percent CI around the indirect effect did not contain zero (simple slope =  $-0.07$ ; LLCI =  $-0.14$ , ULCI =  $-0.01$ ), and the Sobel test (assuming normal distribution) was also significant ( $z = -2.16$ ,  $p = 0.03$ ). Adding respondent age ( $z$ -standardized), gender (dummy-coded), and shopping frequency ( $z$ -standardized) as controls yielded no additional significant main or interaction effects, indicating the robustness of previously established effects of visual complexity.

Repeating the mediation analysis for the path from load to shopping experience through self-control (*H2b*) also yielded a significant effect. Specifically, load was negatively associated with shopping experience ( $B = -0.30$ ,  $t = -3.85$ ,  $p = 0.001$ ). Further, load had a negative effect on self-control ( $B = -0.18$ ,  $t = -2.53$ ,  $p = 0.01$ ), which, in turn, had a significant effect on shopping experience when controlling for load ( $B = 0.31$ ,  $t = 4.02$ ,  $p = 0.001$ ).

When controlling for self-control, the effect of load on shopping experience was significant and negative ( $B = -0.24$ ,  $t = -3.21$ ,  $p = 0.002$ ). Bootstrap results indicated that the 95 percent CI around the indirect effect did not contain zero (simple slope =  $-0.06$ ; LLCI =  $-0.11$ , ULCI =  $-0.02$ ), and the Sobel test (assuming normal distribution) was also significant ( $z = -2.10$ ,  $p = 0.036$ ). Thus, self-control mediated the effect of load on shopping experience, in support of *H2b*.

To test *H3* and the prediction that a utilitarian vs hedonic shopping motivation would moderate the relationship between load and shopping experience, the moderation test procedure was repeated with the corresponding set of variables. The results indicated a direct negative effect of load on shopping experience ( $B = -0.30$ ,  $p = 0.001$ ), a non-significant direct effect of shopping motivation ( $B = 0.03$ ,  $p = 0.74$ ), and a significant effect of the load $\times$ shopping motivation interaction term ( $B = -0.04$ ,  $p = 0.02$ ). Tests of simple slopes showed that the effect of load on shopping experience was significant and negative with individuals in a more utilitarian shopping orientation ( $B = -0.44$ ,  $t = -3.26$ ,  $p = 0.002$ , LL =  $-0.72$ ; UL =  $-0.17$ ), and non-significant with individuals in a more hedonic shopping orientation ( $B = -0.17$ ,  $t = -1.33$ ,  $p = 0.19$ , LL95 percent CI =  $-0.43$ ; UL =  $0.08$ ). Thus, *H3* is supported.

Excluding the possibility that field dependence would moderate the relationship between complexity and load involved adopting the procedure recommended by Frazier *et al.* (2004). The results indicated a direct effect of visual complexity on load

( $B = 0.25$ ,  $p = 0.01$ ), a direct effect of field dependence ( $B = -0.13$ ,  $p = 0.07$ ), and a non-significant effect of the complexity by field dependence interaction term ( $B = 0.01$ ,  $p = 0.51$ ). As in Study 1, adding “store” as a control variable did not generate evidence for rival explanations (store:  $B = 0.05$ ,  $p = 0.42$ ;  $B$  values of complexity and field dependence remain unchanged).

## Summary, implications, and further research

### *Advancement of theory*

This study makes two key contributions. First, the study is the first to explore the concept of perceptual load and related self-regulation consequences in the context of service environments. Orth and Wirtz (2014) established effects of visual complexity on approach/avoidance behaviors through processing fluency, implying that effects may occur because complexity increases perceptual load and depletes resources. The current study confirms the previously untested pivotal role of perceptual load and the mediated relationship via complexity. The findings show that load (Studies 1 and 2) and the reduced self-control it brings (Study 2) mediate the complexity-experience relationship. This result offers an explanation for the process mechanism involved in channeling the effects of visual complexity on customer behaviors. The increased load of visually more complex environments reduces self-control, which in turn mars the shopping experience. That is, visually complex environments can be detrimental to the experience because of the increased load they place on customers.

Second, this study is the first to explore shopping motivation as a moderator of the complexity-shopping experience relationship. Specifically, Study 2 shows that a utilitarian shopping motivation further increases the negative effects of load on experience, hereby extending research on shopping goals and their moderating effects on consumer responses to servicescapes (e.g. Babin *et al.*, 1994; Mattila and Wirtz, 2008). The negative effects of complexity were reduced for consumers with a hedonic shopping motivation. These findings are consistent with the notion that a high degree of visual complexity in service settings is more likely to interfere with and hinder goal attainment in utilitarian settings than it would in hedonic shopping situations. That is, the results from this study confirm that consumers’ shopping goals moderate the impact of perceptual load on their shopping experience.

In addition to these two key findings, this study makes a number of interesting secondary contributions which extend and corroborate extant research on complexity in services environments. First, our studies show that field dependence did not affect the perceptual load obtained from visually complex environments. That is, the negative effects of complex environments can be observed with shoppers regardless of their field dependence. Importantly, this finding is robust across two cultures with different field dependence tendencies (i.e. a Western vs Eastern culture). This finding implies that both field-dependent and independent people pay attention to the field and experience a similar load from complexity (Goodenough, 1987). Disregarding specific objects in a complex environment in favor of taking in the “big picture” implies that an environment’s visual complexity (of which numerous objects are a defining element) has a similar effect on people, independent of their field dependence. This line of reasoning is consistent with the working memory perspective on field dependence as field dependence primarily reflects differences in the operations of the visuospatial and executive components of working memory (Miyake *et al.*, 2001).

Second, recent research has shown that the visual complexity of an interior influences shoppers’ evaluation of the environment’s attractiveness and approach-avoidance

of that environment at entry (Orth and Wirtz, 2014). That is, the key characteristic of the Orth and Wirtz (2014) research is its focus on approach/avoidance behavior as the main dependent variable, with important implications for consumer decision making before (or shortly after they enter an environment), essentially their decision to enter and continue rather than turning around and exit. Complexity effects during and after after-shopping outcomes, however, remained unclear in their study. In contrast, the present study focusses on the experience consumers have while visiting the environment and their post-encounter evaluation (i.e. satisfaction). Our study replicated Orth and Wirtz's (2014) base model by focussing on the in-store experience and post-encounter evaluation, and we can confirm that the findings by Orth and Wirtz (2014) also hold for in-store and post-encounter evaluations. Together, these findings suggest that complexity of a service environment affects consumer responses negatively before, during and after a service encounter.

Third, regarding context, the present study extends the Orth and Wirtz (2014) model (consumer processing of and response to an interior's visual complexity) to a new setting, culture and method. Specifically, it examines grocery stores which are more utilitarian in nature, rather than previously studied cafes and deli shops (which tend to be more hedonic in nature), and it extends their work to a different cultural setting (i.e. to Germany rather than just Singapore). The current study used a quasi-experimental approach rather than an experimental study cum survey. As our study replicated Orth and Wirtz's (2014) base model, the combined findings help to build confidence in the robustness, external validity, and wider applicability of the role of visual complexity in consumer responses to service environments.

### *Managerial implications*

The findings can aid retail managers in more effectively designing and managing store interiors to enhance their customers' shopping experiences. Across two contexts and samples, the results confirm that visual complexity can have a negative impact on shoppers' experience in the store. How visually complex an environment can be depends greatly on the primary motivation of target shoppers. Our findings suggest that having less complex environments is more important when customers have largely utilitarian shopping goals. That is, predominantly utilitarian service environments such as grocery stores (particularly discount stores) and government service offices should aim for somewhere low on the visual complexity spectrum.

Our findings raise the question of how the visual complexity of a store could be reduced. Extant research and the visual characteristics of the stores examined in our research suggest several avenues to achieve this. First, a general approach for decreasing complexity includes reducing the number (Van der Helm, 2000) and variety of visible objects (Oliva *et al.*, 2004).

Second, organizing the special layout in general (Rayner, 2009), and the furniture, merchandise, displays, and signs in particular (Nadal *et al.*, 2010) in a more symmetric manner also lowers the visual complexity of an environment (Rayner, 2009). Likewise, grouping parts according to easy-recognizable themes can lower perceptions of visual complexity. These effects seem to work regardless of how many actual parts there are in an environment (Palmer, 1999), and apply especially when the different parts are easy to identify and are separated from each other through space (Oliva *et al.*, 2004).

Third, environmental design variables such as colors play an important role as reducing their variety and contrast can decrease visual complexity (Heaps and Handel, 1999), as does using surface textures (for floors, ceilings, and walls) with

repetitive and uniformly oriented patterns rather than disorganized and cluttered patterns (Oliva and Torralba, 2001).

It has to be noted, however, that there may be a tradeoff between assortment size (Chernev and Hamilton, 2009) and visual complexity, whereby a larger assortment size could be advantageous from a sales perspective. Therefore, it may be best to first optimize the assortment size from a sales perspective and only then work on reducing the visual complexity of displaying the given assortment size. Research on visual processing (Townsend and Kahn, 2014) and our earlier recommendations suggest that perceptions of complexity can be lowered without actually reducing the range of products displayed. This perspective is consistent with studies of website design (Krishen *et al.*, 2008) showing that the same amount of information on a website can be displayed in different ways so as to relate to divergent levels of perceived complexity with differential effects on the experience. Perhaps more importantly, Kahn *et al.* (2013) report that by simplifying the complexity of the individual items within the assortment, by increasing alignability of attributes, and by using a simplifying external organizational structure for the assortment, large assortments can be offered in a way that minimizes perceived complexity.

Discussions of our findings with three store managers of the Edeka chain in Germany support this view. These managers could think of several ways to reduce the visual complexity of their outlets (as conceptualized in this study) which did not affect assortment size. In other words, complexity can be reduced for a given assortment size by carefully managing and designing the service environment and by better arranging, displaying, and organizing the assortment.

#### *Limitations and further research*

As with any research, this study raises several questions and has limitations that offer opportunities for further research. First, this study is set in a supermarket context and our findings may not directly transfer to environments in which the visual design is an important component of the value proposition to customers (e.g. museums, art galleries), in which ambient conditions are of greater relevance to overall service delivery (e.g. fine dining restaurants), or in which customers desire a service environment that involves complex servicescapes (e.g. theme parks).

Furthermore, although the present study did account for hedonic/utilitarian shopping goals, one should reexamine our findings in more extreme types of shops (e.g. a spa environment for hedonic shopping and a medical clinic for utilitarian). We expect that the findings presented here will be replicated but with more pronounced effects (i.e. complexity will yield much more negative responses in mostly utilitarian shopping environments than in purely hedonic ones). Further research could explore these potential boundary conditions of our findings.

As customer experience can be driven by a wide range of variables, quasi-experiments have the drawback that not all potential confounds can be ruled out. To minimize the risk of rival explanations to our hypothesis testing, the present research controlled for key customer (i.e. age, gender, and frequency of visits), randomized out time- and situation-specific variables (i.e. time of the day, day of the week, level of crowding, and weather), and we minimized potential store-specific confounds by selecting stores that matched on key variables (i.e. size, assortment size, and type of location) within the same chain in each study. Furthermore, we entered “store” as a control variable into our models and can confirm that unobserved store-specific variables do not provide rival explanations for our findings. Any other potential confounding effect would have to be identical in both chains and both countries, and that seems highly unlikely. In sum, the statistical findings

and their robustness across very different cultural contexts, supermarket environments, and samples provides strong evidence for our theoretical model. Nevertheless, future research that replicates our findings in field experiments would be interesting, especially as actual customer behaviors such as time and money spent, and future visitation behavior and share of wallet (i.e. loyalty) could be observed.

In summary, this study provides insights into the basic psychological process of how the visual complexity of retail environments influences the shopping experience contingent on individual and situational characteristics. We hope that the contributions of this study will stimulate further research in this interesting and important field.

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Appendix 1. Illustrative photographs

Visually  
complex  
environments

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**Plate A1.**  
Visually  
less complex  
supermarket –  
Germany

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**Plate A2.**  
Visually more  
complex  
supermarket –  
Germany

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**Plate A3.**  
Visually less  
complex  
supermarket –  
Singapore



**Plate A4.**  
Visually  
more complex  
supermarket –  
Singapore

Appendix 2

Model constructs	Study 1 Cronbach's $\alpha$ Mean (SD) Variance extracted IFC >	Study 2 Cronbach's $\alpha$ Mean (SD) Variance extracted IFC >
Shopping experience (Wirtz and Lee, 2003)	0.77	0.87
The experience was as I expected	4.91(0.83)	4.39(1.12)
My overall expectations with the store were high	58%	76%
On the basis of my shopping trip, I would visit this store again	0.66	0.83
The store is extremely pleasing to me		
Perceptual load (Wirth <i>et al.</i> , 2009)	0.72	–
How much effort did you invest to get the items on your shopping list in this store?	2.13(0.90)	
How much effort did you invest to find your way in this store?	59%	
How much time pressure did you experience when working on your tasks?	0.63	
How physically exhausting was the shopping trip to you?		
Perceptual load (Paas <i>et al.</i> , 2003)	–	0.81
While remembering my items on the shopping list I invested a very high mental effort		3.48(1.02)
While remembering the location of the items in the supermarket I invested a very high mental effort		63%
How much time pressure did you experience while shopping?		0.67
How much difficulty did you experience while shopping?		
Field dependence (Choi <i>et al.</i> , 2007)	0.90	0.87
Everything in the universe is somehow related to each other	4.71(1.27)	5.06(1.04)
Even a small change in the universe can lead to substantial alterations in others	56%	54%
Any phenomenon has many causes although some of the causes are not known	0.66	0.66
Any phenomenon has many results although some of the results are not known		
Nothing is unrelated		
It is not possible to understand the pieces without considering the whole picture		
Paying attention to the field is more important than paying attention to its elements		
A marker of good architecture is how harmoniously it blends with other buildings around it		
Sometimes, the empty space in a painting is just as important as the objects		
Visual complexity (Pieters <i>et al.</i> , 2010)	0.76	0.73
Overall, how complex does this shop environment appear to you?	3.99(0.95)	3.86(1.80)
How ambiguous is the boundary of each object in this environment?	53%	59%
How many different objects do there seem to be?	0.65	0.65
To what degree do there seem to be parts of the scene that are invisible?		
To what degree is the scene either chaotic or organized?		
Shopping goals (Babin <i>et al.</i> , 1994)	–	0.73
Hedonic shopping goals		4.22(1.57)
The shopping trip [visit to the coffee shop] should be truly a joy		53%
I would continue to shop [visit the coffee shop], not because I have to, but because I want to		0.54
The shopping trip [visit to the coffee shop] should truly feel like an escape		
Compared to other things I could have done, the time spent shopping fancy food [visiting the coffee shop] would be truly enjoyable		

(continued)

**Table A1.**  
Scale items and  
summary statistics  
for construct  
measures

	Study 1	Study 2
	Cronbach's $\alpha$	
	Mean (SD)	
	Variance extracted	
	IFC >	
Model constructs		
I would enjoy being immersed in exciting new products		
I would enjoy the shopping trip [visit to the coffee shop] for its own sake, not just for the items I may purchase		
I would have a good time because I would be able to act on the "spur-of-the-moment"		
During the trip [visit], I would feel the excitement of the hunt		
While shopping fancy food [visiting the coffee shop], I am able to forget my problems		
While shopping fancy food [visiting the coffee shop], I would feel a sense of adventure		
Utilitarian shopping goals		
The shopping trip [visit to the coffee shop] would not be a very nice time out ( <i>r</i> )		
I would accomplish just what I want to on the shopping trip [visit]		
I would not buy what I do not really need		
While shopping fancy food [visiting the shop], I would find just the item(s) I am looking for		
I would be disappointed, if I have to go to another store [shop] to complete my shopping		
Perceived self-control (Tangney <i>et al.</i> , 2004)	–	0.88
People would say I have iron self-discipline		4.03(0.91)
Pleasure and fun sometimes keep me from getting work done ( <i>r</i> )		54%
I do not have trouble concentrating		0.54
I often act without thinking through all the alternatives ( <i>r</i> )		
I am self-indulgent at times ( <i>r</i> )		
I am good at resisting temptation		
I refuse things that are bad for me		
I spend too much money ( <i>r</i> )		
I do many things on the spur of the moment ( <i>r</i> )		

Table AI.

Notes: *r*, reverse-coded items; IFC, item-to-factor correlations

Variables	$\alpha$	<i>M</i>	SD	1	2	3	4	5
<i>Study 1 (n = 150)</i>								
1. Shopping experience	0.77	4.91	0.83	–	–	–		
2. Perceptual load	0.72	2.13	0.90	–0.30**	–	–		
3. Field dependence	0.90	4.71	1.27	0.08	–0.06	–		
4. Visual complexity	0.76	3.99	0.95	–0.19**	0.26**	–0.13		
<i>Study 2 (n = 133)</i>								
1. Shopping experience	0.87	4.39	1.12	–	–	–	–	–
2. Perceptual load	0.81	3.48	1.02	–0.21**	–	–	–	–
3. Field dependence	0.87	5.06	1.04	0.11	–0.15**	–	–	–
4. Visual complexity	0.73	3.86	1.80	–0.18**	0.20**	–0.09	–	–
5. Shopping goals	0.73	4.22	1.57	0.04	–0.05	–0.10	0.14	–
6. Perceived self-control	0.88	4.03	1.91	0.22**	–0.18**	0.08	–0.22**	0.10

Table AII.  
Descriptive statistics and study variable intercorrelations

Notes: \**p* < 0.05; \*\**p* < 0.01

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