

## Aesthetic package design: A behavioral, neural, and psychological investigation

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### Abstract

In four experiments, this research sheds light on aesthetic experiences by rigorously investigating behavioral, neural, and psychological properties of package design. We find that aesthetic packages significantly increase the reaction time of consumers' choice responses; that they are chosen over products with well-known brands in standardized packages, despite higher prices; and that they result in increased activation in the nucleus accumbens and the ventromedial prefrontal cortex, according to functional magnetic resonance imaging (fMRI). The results suggest that reward value plays an important role in aesthetic product experiences. Further, a closer look at psychometric and neuroimaging data finds that a paper-and-pencil measure of affective product involvement correlates with aesthetic product experiences in the brain. Implications for future aesthetics research, package designers, and product managers are discussed.

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### Introduction

“Man shows that he is affected by appearance, by something that causes him pleasure over and above the immediate utility of the object” (Clay, 1908).

Designing and marketing aesthetic products is of growing importance in markets where many basic needs of consumers have been satisfied. As core product attributes, such as quality and functionality, become increasingly homogeneous (Reimann, Schilke, & Thomas, 2010), firms are shifting their differentiation efforts away from concrete product characteristics towards less tangible features such as aesthetics (Brunner, Emery, & Hall,

2009). For example, Alessi's lemon squeezer is functionally poor for squeezing lemons, but the unique design makes it a pleasant and interesting kitchen ornament. Coca-Cola has taken steps to creating special limited edition designs of their famous curved bottle for the Olympics, Christmas seasons, and other special events. In fact, design and aesthetics are said to be major differentiating attributes in the choice and preference of consumer goods (Zolli, 2004).

This trend towards aesthetics in product differentiation may be based on the insight that regardless of the consumption domain, aesthetic designs seem to trigger certain positive responses in consumers such as an immediate desire to own the product (Norman, 2004); a higher willingness to pay for it (Bloch, Brunel, & Arnold, 2003); and an increased inclination to show off and care for that product (Bloch, 1995). More importantly, while products purchased solely for their functional utility may lose their appeal when becoming technically obsolete, products with aesthetic qualities may be treasured long after their functional value fades (Martin, 1998).

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Despite high managerial relevance and important previous research on the psychological understanding of aesthetics, especially package design (e.g., Hagtvedt & Patrick, 2008; Peracchio & Meyers-Levy, 1994), little is known about core behavioral, neural, and psychological mechanisms when consumers experience aesthetically designed packages. While prior neuroscientific research has improved our understanding of the neural correlates of beautiful faces (e.g., Aharon et al., 2001), beautiful geometric shapes (e.g., Jacobsen et al., 2006), the neural basis of aesthetic preference for paintings and pictures (e.g., Cela-Conde et al., 2004), and the brain correlates of aesthetic expertise (Kirk et al., 2009), knowledge on the neural underpinnings of aesthetic package experiences is nonexistent in the literature. Although packaging, as an integral design element, has recently been investigated by Orth and Malkewitz (2008), these authors lament that there is no good psychological theory when it comes to packaging aesthetics and further research is necessary.

Reaction time has been shown to be a valid measure of the time it takes to carry out basic mental processes (Luce, 1986) and, thus, may help to elicit knowledge about underlying processes of aesthetics (de Tommaso et al., 2008). Additionally, choice as a behavioral measure simply sheds light on individuals' preference construction (Bettman, Luce, & Payne, 1998). Therefore, both reaction time and choice measures seem appropriate to gain further understanding of the underlying processes of aesthetic packaging. By adding functional magnetic resonance imaging (fMRI) to the research, the analysis of psychological processes in the brain at the point in time when they take place – and not in retrospective – becomes possible. This is because fMRI is not subject to cognitive processes overlapping actual affective processes as participants do not have to remember an aesthetic experience as when answering a survey item.

In summary, we propose that the combination of several behavioral, neural, and psychological concepts and measures in the present research will shed light on the unique characteristics of aesthetic experiences and, therefore, may enlighten the conceptualization of aesthetic product experiences as well as their measurement. In experiments 1a and 1b, we attempt to behaviorally differentiate aesthetic from standardized package design by measuring reaction times of participants choosing between differently packaged products. In experiment 2, we attempt to behaviorally isolate packaging design from the effects of brand and price. Finally, replicating the behavioral choice task from experiment 2, experiment 3 uses fMRI to shed light on the underlying processes in the brain, which helps explain why consumers choose aesthetically pleasing packages.

### Conceptual background and hypotheses

The terms aesthetics was coined by Baumgarten in 1735, based on the Greek word *aisthēsis* (i.e., perception from the senses, feeling, hearing, and seeing), and he subsequently defined aesthetics as “perfection of sensate cognition” (cf. Osborne, 1979). In the present research, we focus on the underlying affective processes of aesthetic product packaging,

how these may become evident in behavior (i.e., longer reaction times and choice) as well as the brain's reward system (e.g., Aharon et al., 2001), and their correlation with self-reported product involvement (e.g., Zaichkowsky, 1986, 1994).

Related streams of work in consumer research concentrate on the determinants of psychological processes and behavioral responses, especially the aesthetic object itself. For example, Bloch (1995) developed a conceptual model describing how the form of a product impacts consumers' psychological and specific behavioral responses and Hoegg, Alba, and Dahl (2010) revealed a bias in the direction of the unattractive product when aesthetics and product feature performance conflict. Furthermore, Veryzer and Hutchinson (1998) identified unity and prototypicality as important visual aspects of product package design that trigger aesthetic responses in consumers, Hagtvedt and Patrick (2008) studied how the use of visual art on products influences consumers' perception and evaluation of products, and Deng, Hui, and Hutchinson (2010) investigated consumers' preferences for aesthetic color combinations. While the former line of work informs about psychological mechanisms that underlie aesthetic experiences, the latter research stream helps identify types of stimuli that are highly aesthetic in nature.

### *Affect and cognition of aesthetics*

In psychology, several views on aesthetics have developed: for example, empirical aesthetics (e.g., Berlyne, 1974), aesthetic emotion (e.g., Clay, 1908), Gestalt theory (e.g., Eysenck, 1942), psychoanalysis of aesthetics (e.g., Hanly, 1986), and psychology of art (e.g., Arnheim, 1974). Besides these psychological views, theories on aesthetics have also originated in other disciplines such as low-complexity theory in computer science (Schmidhuber, 1997). Within these various research streams, aesthetics and related terms of aesthetic appreciation, experience, judgment, perception, and preference have been related to arousal (Berlyne, 1974), prototypicality (Martindale, 1988), and appraisals (Silvia, 2005).

Recently, Leder, Belke, Oeberst, and Augustin (2004) proposed a psychological framework of aesthetic experience, including a five-stage process, which includes the perceptual analyses of the object of aesthetic interest, implicit memory integration, explicit classification, cognitive mastering, and evaluation. This process results in aesthetic judgment and aesthetic emotion. While aesthetic judgment (i.e., the cognitive element) is argued to be a result of understanding ambiguity in the object, Leder et al. (2004) further posited that aesthetic emotion (i.e., the affective element) may be seen as a result of continuous and satisfactory affective evaluation while processing the five process stages.

Based on these insights into underlying psychological mechanisms, we would predict differences in affective processing for consumers confronted with aesthetic packaging design compared to standardized packaging. A useful measure of affective processing is reaction time (Sternberg, 2004). We would expect more intense emotional responses and, thus, longer reaction times for product packaging design that is

aesthetic versus product packaging that is standardized (Chatterjee, 2004). For example, de Tommaso et al. (2008) indicate that after viewing beautiful paintings participants' reaction times were somewhat slower and Madsen, Brittin, and Capperella-Sheldon (1993) found longer response times in the aesthetic experience to music. As such, we propose that aesthetic product package designs also elicit longer reaction times to arrive at choice than standardized packaging, resulting from increased affect (e.g., more emotional responses). Therefore, we hypothesize:

**H1.** The more aesthetic the product packaging design, the more affective processes will be engaged, resulting in increased reaction times.

### *Reward value of aesthetics*

In affective and cognitive neuroscience, recent studies have tried to draw neural frameworks of aesthetics, recently evolving into a research domain coined “neuroaesthetics” (Nalbantian, 2008). Ramachandran and Hirstein (1999) offer a set of heuristics that artists either consciously or nonconsciously use to optimally stimulate visual brain areas. Further, Chatterjee (2004) developed a conceptual model of visual aesthetics, which was adapted from the cognitive neuroscience of vision. After the viewer is confronted with the visual stimulus, the model proposes a phase of early vision (i.e., a processing of color, luminance, shape, motion, and location), followed by a phase of intermediate vision (i.e., grouping of these features). These phases are coupled with attention and a representational domain (e.g., places or faces) and subsequently followed by an emotional response (i.e., liking versus wanting) and then the decision.

In a follow-up study, Nadal, Munar, Capo, Rossello, and Cela-Conde (2008) laid empirical results over Chatterjee (2004) conceptual framework by comparing it to three different neuroimaging studies. First, Nadal et al. (2008) argued that the cortical component of reward value of the aesthetically judged stimuli corresponds to activity in the medial orbitofrontal cortex. That is, visual stimuli rated as beautiful were associated with a higher reward value in participants' brains than those rated as ugly (Kawabata & Zeki, 2004). Second, the subcortical component of reward value was identified in the caudate nucleus by Vartanian and Goel (2004). Nadal et al. (2008) proposed that increased activation in the motor cortex could represent reward magnitude of ugly stimuli or the motor readiness elicited by them (Kawabata & Zeki, 2004). The subjective emotional experience associated with aesthetically preferred stimuli was identified in the anterior cingulate cortex by Vartanian and Goel (2004). Third, the decision component of Chatterjee's (2004) framework was identified in Cela-Conde et al. (2004) work. Here, Nadal et al. (2008) admitted that it is not possible to determine whether the identified brain activity in the left dorsolateral prefrontal cortex reflects decisions based on perceptual information or on information regarding reward value or on both.

Although the insights into the visual and decision-making processes in the brain are interesting, the findings on emotional responses seem to be most promising for the present research. These findings suggest that reward is what may trigger aesthetic preference, judgment, and subsequently decision (Leder et al., 2004). Reward in general can be defined as the positive value an individual ascribes to an object, behavioral act, or an internal physical state (Wise & Rompre, 1989). For the present research, reward is understood as the wanting of an aesthetic product. In their neural theory of aesthetic experiences, Ramachandran and Hirstein (1999) claimed that experiencing aesthetics is by itself rewarding. This claim is supported by several empirical neuroimaging studies: Aharon et al. (2001) found that the perception of beautiful faces activates areas of the brain that have been associated with the reward system, particularly the nucleus accumbens; Kampe et al. (2001) identified increased activation in the ventral striatum when an attractive faces looks directly at the viewer instead of when eye gaze is directed away (also indicating that the reward system is engaged); and Bloch et al. (2003) showed that smiling, beautiful faces produce activation of the medial orbitofrontal cortex, a brain area which is argued to be involved in representing stimulus-reward value. These findings are in line with the studies reviewed earlier, which also found activation in the medial orbitofrontal cortex (Kawabata & Zeki, 2004) as well as the caudate nucleus (Vartanian & Goel, 2004), the latter which is also an area of the striatum.

In summary, we build the following hypothesis H2 on the theory of reward: While experiencing aesthetic products (i.e., after early vision, when emotional responses are elicited), we predict that key areas of the reward system in the brain are significantly more activated for aesthetic versus standardized packaging design. These brain areas could incorporate the striatum (which includes the nucleus accumbens and the caudate nucleus) as well as the ventromedial prefrontal cortex. Here, research generally differentiates between anticipated reward (i.e., in the striatum) and reward outcome (i.e., in the ventromedial prefrontal cortex) (Knutson & Cooper, 2005). We expect that increased activation in these areas arises at the point in time when consumers experience (i.e., emotionally respond to) the aesthetic product and not before (i.e., while still perceiving it and processing early or intermediate vision) or after (i.e., while making a decision). This notion is in line with the account of affect anticipation (e.g., Bechara et al., 1997). Taken together, we expect that individuals ascribe a highly positive value to the aesthetic object they are viewing, that individuals generate wanting of an aesthetic package, and that this become evident in the reward system in the brain. We hypothesize:

**H2.** The more aesthetic the product packaging design, the more activated the striatum, particularly the nucleus accumbens, and the ventromedial prefrontal cortex will be.

### *Product involvement and aesthetics*

One psychological construct that has been brought forward in research on aesthetic products is product involvement. Martin

(1998) argues that promoting aesthetic attributes of a product may further elevate consumers' involvement with the product. Product involvement is considered a motivational construct, which partly relies on antecedent factors of a person's values, needs, and interests in relation to a product. However, another factor that is hypothesized to lead to higher involvement is product differentiation (Zaichkowsky, 1986). In addition to the notion of high and low involvement, Vaughn (1980) introduced the idea of cognitive versus affective types of products, or thinking versus feeling products. While cognitive, or thinking products are thought to be those which focus on performance attributes and are highly substitutable, perhaps even being dominated by price in the decision, affective, or feeling products are different because they focus on pleasure and hedonic value.

When a product touches one's emotional self, it may automatically elicit an affective response. Affective involvement, thus, stresses a person's feelings and achievements of certain emotional states. It can be also used to explain emotions, moods, and feelings evoked by a product. Based on these theoretical assessments, we would propose that affective involvement is strongly associated with aesthetic product package design. We extend this thought and argue that aesthetic product packaging design may work as effective product differentiator even in product categories that do not tend to generate strong involvement and are not ego expressive or conspicuous. Thus, we hypothesize:

**H3.** The more aesthetic the product packaging design, the more affectively involved consumers will be.

## Experiment 1A

### Overview and method

In our first experiment, we attempt to differentiate aesthetic from standardized packages through reaction times and choice. Our between-subjects, repeated measure experimental design included two different conditions: in the aesthetic condition, we presented subjects with 80 different product packages that were pre-selected according to important visual aspects of aesthetic package design such as beauty, unity, and prototypicality (e.g., orange juice in a carafe-formed bottle) (Orth & Malkewitz, 2008; Veryzer & Hutchinson, 1998). In the standardization condition, we presented another 80 product packages that were pre-selected based on their functionality and practical utility (e.g., orange juice in a Tetra Pak). Picture stimuli were pretested among 16 undergraduate students, which were given definitions of aesthetics versus standardized product packaging (i.e., "an aesthetic product package typically is holistically beautiful, original, and prototypical" versus "a standardized package typically is functional and practical") and were shown 250 different packages. All pictures had been identified by an independent judge earlier. Participants were then asked to categorize each picture as being aesthetic or standardized. One hundred and sixty pictures were kept for experiment 1a (80 were categorized as aesthetic by over 80% of respondents and 80 were classified as standardized by over 80% of respondents).

The product categories remained the same across conditions. Each trial started with a brief preparation phase, followed by the product presentation. Once seeing the stimuli, participants were given four seconds to decide, by pressing 1 ("Choose") or 2 ("Don't choose") on their keyboard. The experiment was conducted with an online task. A total of 326 respondents were recruited through a commercial web survey research company and randomly assigned to each condition, resulting in 326 participants  $\times$  80 product choices = 26,080 different product choices (i.e., 13,040 choices in the aesthetics condition and 13,040 choices in the standardization condition).

### Results

We simply counted the number of choices in both conditions and found that participants in the aesthetics condition pressed "Choose" significantly more often than in the standardization condition. Overall, products in the aesthetics conditions were chosen 69% of the time (31% of the time they were not chosen), while products in the standardization condition were chosen only 57% of the time (43% of the time they were not chosen) ( $\chi^2 = 149.06$ ,  $df = 1$ ,  $p < .001$ ). Further, a comparison of the reaction times (RT) in milliseconds (ms) made in the aesthetics condition versus the standardization condition was performed using an independent sample *t*-test. In order to compare reaction times between subjects, for each participant, we first calculated an aggregate RT for "Choose" and an aggregate RT for "Don't choose" to account for the repeated measure design. Reaction time was measured as the interval between the trial onset and the button press during the choice phase. Participants' reaction times in the aesthetics condition were significantly longer than in the standardization condition for both "Choose" ( $M_{RT \text{ choose aesthetics}} = 2010$  ms versus  $M_{RT \text{ choose standardization}} = 1564$  ms,  $t(324) = 13.15$ ,  $p < .001$ ) and "Don't choose" ( $M_{RT \text{ don't choose aesthetics}} = 1661$  ms versus  $M_{RT \text{ don't choose standardization}} = 948$  ms,  $t(324) = 25.38$ ,  $p < .001$ ).

### Discussion

In experiment 1a, when the visual product stimuli were richer in their aesthetic appeal, participants not only pressed "Choose" more often but also took significantly longer to arrive at this choice. Moreover, the results suggest that increases in reaction times for aesthetic versus standard product packages apply to both chosen and non-chosen products. One possible explanation for this finding could be that participants were attracted to aesthetic packaging but the product itself was not one they would choose. Although these results are consistent with our account of affective processes of aesthetics impacting product choice, they suffer from one major shortcoming: although aesthetic packages (vs. standardized packages) may indeed have generated longer reaction times, the findings could be influenced by the between-subject design. In particular, since participants in the aesthetics condition were repeatedly confronted with aesthetic packaging design, they could have developed a strong hedonic mood over the course of the task. We therefore designed experiment 1b to address this issue.

## Experiment 1B

### Overview and method

In experiment 1b, we replicated experiment 1a, but ran it within subjects, so all participants were presented with both aesthetically and standard packaged products. We used a shorter version of the task from experiment 1a with 80 stimuli (i.e., 40 aesthetic and 40 standardized packages, randomly selected from the longer version of the task). Participants again were given a maximum of four seconds to press 1 (“Choose”) or 2 (“Don’t Choose”). Subjects were recruited from graduate classes at a large private university. A total of 82 respondents participated, resulting in  $82 \times 80 = 6560$  different product choices (i.e., 3280 choices on aesthetic packaging design and 3280 choices on standardized packaging design).

### Results

The results of experiment 1b strongly replicated those of experiment 1a. The frequency count of choices of aesthetics packages was significantly greater than for standardized packages. While products with aesthetic packaging were chosen 73% of the time (27% did not choose), standardized products were chosen only 54% of the time (46% did not choose) ( $\chi^2 = 93.19$ ,  $df = 1$ ,  $p < .001$ ). Further, a comparison of reaction times was performed using a paired *t*-test. As a result, participants’ reaction times for the aesthetic products were significantly longer than for the standardized products for both “Choose” ( $M_{RT \text{ choose aesthetic}} = 2221$  ms versus  $M_{RT \text{ choose standardized}} = 1756$  ms,  $t(81) = 11.46$ ,  $p < .001$ ) and “Don’t choose” ( $M_{RT \text{ don't choose aesthetic}} = 1444$  ms versus  $M_{RT \text{ don't choose standardized}} = 975$  ms,  $t(81) = 11.67$ ,  $p < .001$ ).

### Discussion

Although the results of experiments 1a and 1b provide support for H1 (i.e., increased affective processing takes places for aesthetic products, resulting in increased reaction times), a remaining issue in experiments 1a and 1b could be the visual product stimuli themselves. These stimuli not only featured the packaging design but also the brand. Hence, a brand can be a strong attribute of the holistic product impression (Orth & Malkewitz, 2008) as it serves two main purposes: identification and differentiation. Past research has shown that consumers rely on well-known brand names for choice because these brands simplify choice, promise a particular quality level, reduce risk, and engender trust (Keller & Lehmann, 2006). Consumer choice for lesser known brands is mainly driven by a price discount from the well-known national brand (Sethuraman & Cole, 1999). The size of the price premium consumers will pay for a national brand mainly depends on their perception of differences in quality between the national brand and other competitors. To understand brand and price as additional product attributes that impact product choice, we conducted experiment 2.

## Experiment 2

### Overview and method

In experiment 2, we separated packaging design and brand by rendering the visual product images in order to isolate packaging design from brand and also price. We carefully replaced all brand-related information such as brand name and logo using commercially available graphic design software for products from 20 different frequently purchased grocery products (e.g., butter, chocolate, cookies). Further, we researched prices at three different supermarkets and calculated an average price for each product.

Product presentations were manipulated according to three factors: packaging design (aesthetic vs. standardized), brand (well-known vs. unknown), and price (30% above average vs. 30% below average). For the first two factors, this led to four different configurations: (1) aesthetic packaging design and well-known brand, (2) aesthetic packaging design and unknown brand, (3) standardized packaging design and well-known brand, and (4) standardized packaging design and unknown brand. Additionally, each of these four configurations was presented randomly with either a high or a low price. In summary, this within-subjects experiment included 160 trials (20 products  $\times$  4 configurations  $\times$  2 prices) and is depicted in Fig. 1.

Experiment 2 was conducted in a university laboratory setting and a total of 176 respondents participated, resulting in a data set of  $176 \times 160 = 28,160$  different product choices (i.e., 14,080 choices on aesthetic packaging design and 14,080 choices on standardized packaging design).

### Results

Since experiment 2 was not designed for a reaction time comparison (i.e., participants were asked to make their choices after the product and the price were presented), our analyses focus on the differences in actual product choices. We identified significant differences in the choices when comparing frequencies across packaging design, brand, and price (Table 1).

A chi-square test of the frequency counts of choices between aesthetic and standardized packaging design revealed significant differences (9187 of all choices were “Yes” choices and based aesthetic packaging design, equaling to 33%, while only 5914 choices were “Yes” choices based on standardized packages, equaling to 21%) ( $\chi^2 = 709.39$ ,  $df = 1$ ,  $p < .001$ ). While this result replicates the choice data from experiments 1a and 1b, it also sheds further light on the additional effects of aesthetic product packaging when comparing it to brand and price.

Specifically, two comparisons are most interesting: first, participants choose aesthetic package designs with an unknown brand and at a low price significantly more often than a well-known brand at a low price but in a standardized package (73% versus 54%,  $\chi^2 = 100.10$ ,  $df = 1$ ,  $p < .001$ ); and second, even if the price was high, participants still chose the aesthetic product packaging with an unknown brand over the standardized

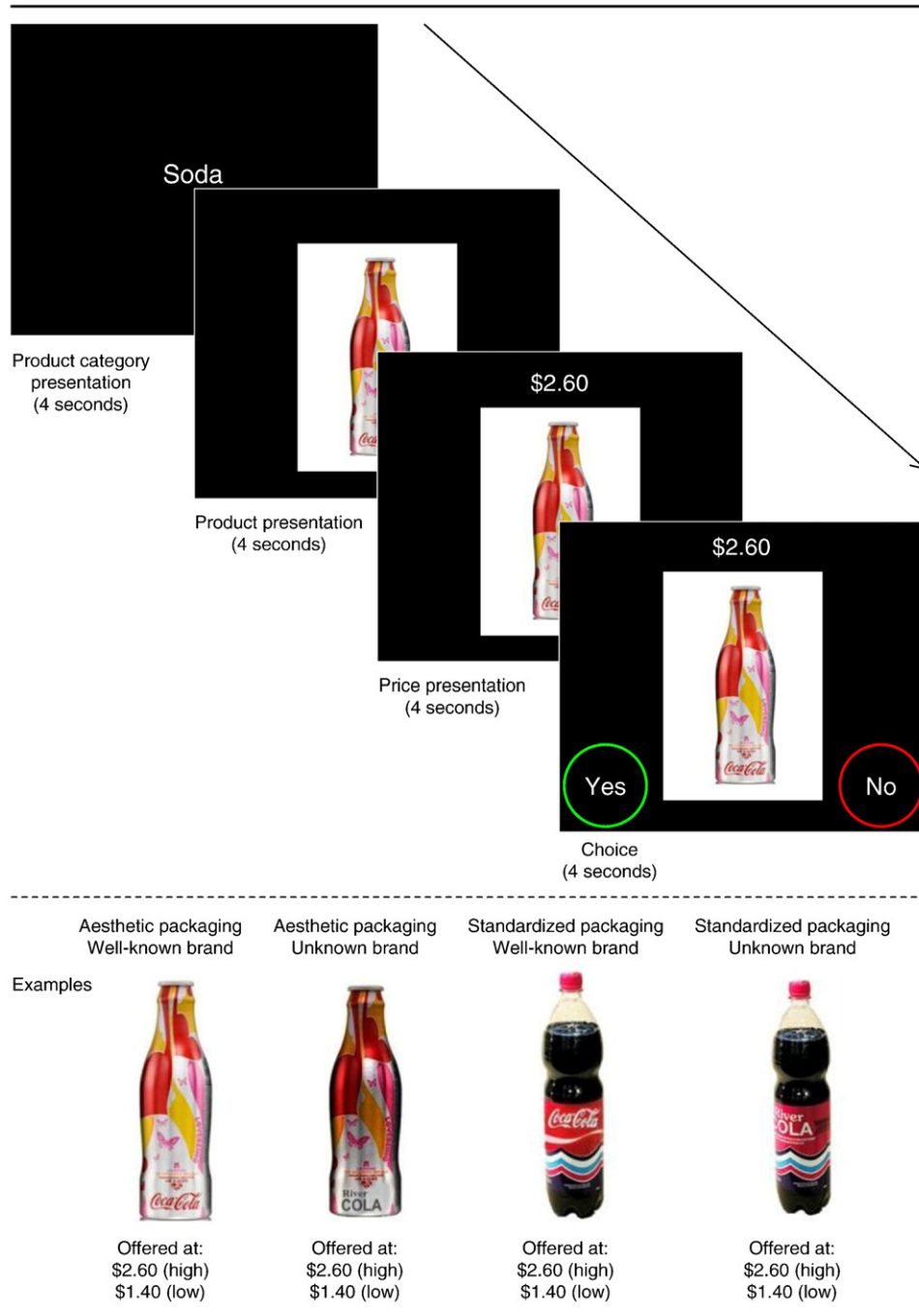


Fig. 1. Choice task used in experiments 2 and 3.

Table 1  
Percentage of choices in experiment 2.

Choice	Aesthetic packaging design				Standardized packaging design			
	Well-known brand		Unknown brand		Well-known brand		Unknown brand	
	High price	Low price	High price	Low price	High price	Low price	High price	Low price
Yes	56%	81%	51%	73%	42%	54%	28%	44%
No	44%	19%	49%	27%	58%	46%	72%	56%

package with the well-known brand (51% versus 42%,  $\chi^2=30.7$ ,  $df=1$ ,  $p < .001$ ). Looking at reaction time to choice, experiment 2 did not reveal significant differences across conditions. This was likely because in experiment 2, participants had already viewed each stimulus for a total of eight seconds (i.e., 8000 ms) before having the chance to press the choice button. As such, participants' choice reaction times for the aesthetic products compared to the standardized products were not significantly different across conditions ( $M_{RT \text{ Yes aesthetic}}=874$  ms versus  $M_{RT \text{ Yes standardized}}=877$  ms, n.s.;  $M_{RT \text{ No aesthetic}}=811$  ms versus  $M_{RT \text{ No standardized}}=825$  ms, n.s.).

### Discussion

Experiment 2 isolated packaging designs from brand and price and found that aesthetic packaging design with an unknown brand at a higher price leads to more choices than a well-known brand in a standardized package at a high price. In summary, we provide additional support for the findings on product choice from experiments 1a and 1b, sustaining the notion that aesthetic products positively trigger product choice. Yet, aesthetic design did not trigger more choices for well-known brands than unknown brands. One explanation could be that participants were drawn to the more aesthetic package more because it was different on both the brand and package, hence creating more effort to process the choice. Additionally, findings suggest that longer reaction times for aesthetic packages may be more attributable to processing during product presentation than during choice. Key questions of this research remain unanswered so far; that is, (1) does an increase of certain affective processes become evident in the brain and potentially explain increased response times? (2) are these processes related to reward value? and (3) is a paper-and-pencil test of affective involvement associated with a reaction to aesthetic package design in the brain? We designed experiment 3 to answer these questions.

### Experiment 3

#### Overview and method

The objective of experiment 3 was to have participants make decisions on aesthetic versus standardized stimuli while undergoing functional magnetic resonance imaging (fMRI). Participants underwent the same experimental task as in experiment 2. Complementing behavioral results from our previous experiments, fMRI allows for a direct measurement and localization of brain activations, which helps to provide confirmatory evidence about the existence of psychological phenomena and to generate a more fundamental conceptualization and understanding of underlying processes (Shiv et al., 2005).

Seventeen participants (nine females) volunteered for experiment 3, which was conducted at a large public university. All participants were right-handed, according to the Edinburgh Handedness Scale, and healthy, without any history of neurological or psychiatric disease. Participants were invited

to the brain imaging facility, gave written informed consent, and successfully performed a medical screening for neuroimaging eligibility. Further, participants performed a shorter training version of the task from experiment 2 to alleviate unnecessary confusion or learning effects. Once inside the brain scanner, participants were presented with and responded to the same version of the task from experiment 2 while lying on their backs, resulting in a data set of  $17 \times 160 = 2720$  different choices (i.e., 1360 choices on aesthetic packaging design and 1360 choices on standardized packaging design). Participants could see the task stimuli through video goggles in front of their eyes. They provided responses by pressing one of two buttons on a response grip, which they held in both hands (see the Appendix for a detailed reporting of the fMRI data collection and analysis procedures). After the brain scan session, participants responded to a paper-and-pencil measure of product involvement with five items for affective involvement (i.e., interesting, exciting, appealing, fascinating, and involving) and cognitive involvement (i.e., important, relevant, means a lot to me, valuable, and needed) for every product (Zaichkowsky, 1994).

### Results

The behavioral results of experiment 3 replicated those of our previous experiments as the frequency count of choices of aesthetics packages was significantly greater than for standardized packages. While products with aesthetic packaging were chosen 52% of the time (48% did not choose), standardized ones were chosen only 46% of the time (54% did not choose) ( $\chi^2=7.96$ ,  $df=1$ ,  $p < .01$ ). As in experiment 2, participants in experiment 3 had also already viewed each product packaging for a total of eight seconds (i.e., 8000 ms) before having the chance to press the choice button. As expected, participants' choice reaction times for the aesthetic products compared to the standardized products were not significantly different across conditions ( $M_{RT \text{ Yes aesthetic}}=722$  ms versus  $M_{RT \text{ Yes standardized}}=725$  ms, n.s.;  $M_{RT \text{ No aesthetic}}=755$  ms versus  $M_{RT \text{ No standardized}}=790$  ms, n.s.).

We found significant differences in brain activation between the aesthetic and standardized condition. Because we were mainly interested in the implicit valuation process of the product, which mainly takes place during first contact with the product, we concentrated our analyses on the presentation phase of the products. For aesthetic products, we found significant increases in activations in the ventromedial prefrontal cortex (vmPFC) [Montreal Neurological Institute (MNI) coordinates:  $-9/40/-11$ ,  $z=3.58$ ,  $p < .001$ , cluster size  $k=25$ ], the striatum, particularly the right nucleus accumbens [ $14/7/-6$ ,  $z=3.42$ ,  $p < .001$ ,  $k=15$ ], as well as in the cingulate cortex [ $12/36/29$ ,  $z=3.70$ ,  $p < .001$ ,  $k=55$ ]. Further, the primary visual cortex [ $-21/-88/6$ ,  $z=3.62$ ,  $p < .001$ ,  $k=110$ ] and the precuneus [ $12/-42/41$ ,  $z=2.75$ ,  $p < .001$ ,  $k=53$ ] were active (see Fig. 2).

For these brain areas, we specifically analyzed the influence of packaging and brand. This analysis revealed significantly stronger brain activation in the vmPFC for aesthetic versus standardized products ( $-9/40/-11$ ,  $p < .001$ ). This effect was mainly driven by the impact of aesthetic package design on

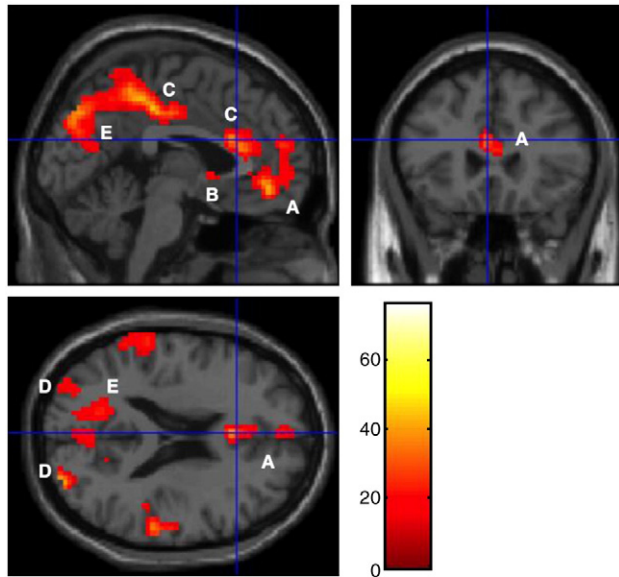


Fig. 2. Significantly stronger brain activations in the ventromedial prefrontal cortex (A), striatum, particularly nucleus accumbens (B), cingulate cortex (C), primary visual cortices (D), and precuneus (E) during aesthetic product presentations. Note: The color bar shows the  $F$ -value of the  $F$ -contrast, revealing the main effects of aesthetic versus standardized products in the product presentation phase of the task.

unknown brands (see Fig. 3). For example, higher vmPFC activations occurred while presenting a highly aesthetic soda bottle with an unknown brand. No main effect of well-known versus unknown brand was observed at a threshold of  $p < .001$ .

To investigate the link between product involvement and brain activation during product perception, we triangulated affective and cognitive product involvement scores (i.e., an aggregate score of the five items for affective product involvement and an aggregate score of the five items measuring cognitive product involvement) with the beta value of brain activation. We correlated these scores with activation differences in the striatum, as the striatum has been related to reward

evaluations and affective modulations (Kable & Glimcher, 2007). Previous studies have demonstrated the importance of the striatum in the goal-directed evaluation of affective stimuli (Delgado, 2007) and the coding of deviations of actual rewards from expectations (Knutson & Wimmer, 2007).

The analysis of scale data and neuroimaging data revealed strong positive correlations between affective involvement and the activation difference between aesthetic and standardized products ( $r = .69, p < .01$ ). An opposite effect was observed for cognitive involvement ( $r = -.52, p < .01$ ). Further analyses did not reveal significant correlations between product involvement and brain activation in areas other than the striatum. One explanation for the significant positive relationship between self-reported product involvement and activity in the striatum could be that involvement for products is related to salience, which has been shown to be related to striatal activity (Zink, Pagnoni, Martin, Dhamala, & Berns, 2003). Higher involvement may therefore lead to increased salience of presented products, which would increase striatal activity.

### Discussion

Replicating our findings on choice from experiments 1a, 1b, and 2, results of experiment 3 reveal that participants choose aesthetic product packaging significantly more often than standardized packaging. As already found in experiment 2, the reaction times to choice again did not significantly differ in experiment 3, likely because participants had seen the stimuli for some time before choice. This finding suggests that longer reaction times for aesthetic product packages may be more attributable to processing during product presentation rather than during choice.

Further, consistent with our hypothesis H1, we found that participants engage specific affective brain areas when experiencing aesthetic package design. In particular, we found that the striatum plays an important role, suggesting that reward (i.e., wanting the aesthetic product) triggers aesthetic preference,

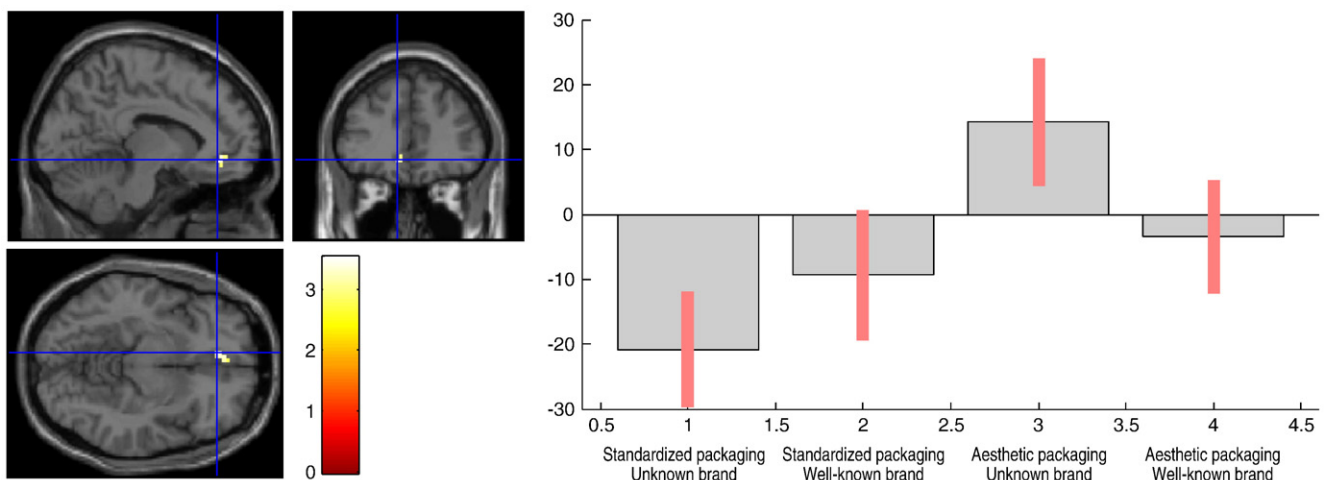


Fig. 3. Significant activations in the ventromedial prefrontal cortex, by condition. Note: The color bar displays the  $t$ -value of the one-sample  $t$ -test (i.e., the lighter the color, the greater the  $t$ -value), wherein the group contrast images were tested against a null hypothesis of no effect [Montreal Neurological Institute (MNI) coordinates:  $-9/40/-11$ ]. The scale on the right displays the percentage of activation change in the ventromedial prefrontal cortex.



judgment, and subsequently decision (Leder et al., 2004). This finding is in line with Aharon et al. (2001), who found that viewing beautiful faces activates the nucleus accumbens (i.e., a part of the striatum). Moreover, Kampe et al. (2001) identified increased activation in the ventral striatum when attractive faces were viewed.

Besides the striatum, we find increased activation in the ventromedial prefrontal cortex for aesthetic packaging compared with standardized packaging. Prior research has related the ventromedial prefrontal cortex to reward value (O'Doherty et al., 2001). When we further differentiated our analysis between brands (well-known versus unknown), we found increased activation in the ventromedial prefrontal cortex for aesthetic products and unknown brands and decreases for the other three conditions (i.e., standardized package and well-known brand, standardized package and unknown brand, and aesthetic package and well-known brand, see Fig. 3). This particular finding illustrates that aesthetic packaging design may have a reward value that is significantly stronger than the effect of a well-known brand. Moreover, we found increased activation in the anterior cingulate, which is in line with prior research of viewing aesthetically preferred stimuli (Vartanian & Goel, 2004). Additionally, we find increased activation in the visual cortex, suggesting a greater visual processing when viewing aesthetic products compared with standardized products.

In summary, our neuroimaging data supports the position that the reward system in the brain plays a significant role in processing aesthetic package design (supporting H2). Moreover, we find that a paper-and-pencil measure of affective involvement is positively related to aesthetic experiences (supporting H3), and the measure of cognitive involvement is negatively related to aesthetic stimulation of the brain. Interestingly, the latter correlation suggests that cognitive involvement is inversely associated with an increase in experience of reward for aesthetic packaging in the brain. In other words, lower scores on the items for cognitive involvement are associated with aesthetic experiences. Taken together, this finding suggests that aesthetic packaging is indeed exciting and appealing (i.e., affectively involving) but not necessarily needed or important (i.e., cognitively involving).

## General discussion

Using a novel reaction time task, we found that participants took consistently longer to choose aesthetic products than standardized ones (experiments 1a and 1b); that unknown brands with aesthetic packaging are chosen even over well-known brands with standardized packaging, despite higher prices (experiment 2); and that increased activation in the reward system helps explain these behavioral differences (experiment 3). Together, these results show why and how the choice of frequently purchased goods is influenced by aesthetic package design.

Yet, some important questions remain. Context effects are extremely important in the evaluation of packaging of frequently purchased goods. Grocery stores contain tens of

thousands of items and consumer decisions are repetitively made in seconds. Perhaps, the importance of aesthetic effects in package design may be hindered if all packages within a product category are aesthetic and there is no plain choice. Would consumers choose the one that stands out, or is prominent, and what would the decision rule look like? Given our results, we expect the choice process might be longer and follow a conjunctive choice rule. Brands in bland packaging would be eliminated from the choice set and then decisions would be made among the remaining brands with more visual appeal.

Or is it just that humans need variety in their lives? When something new comes into the visual field, consumers must take the time to figure it out and they are stimulated because they must now categorize that object into a shelf in the brain. There is a new neural network created rather than a repeat visit of a past stimulus with a new package. Humans may need to be stimulated for a healthy brain and perhaps that is why differentiation leads to involvement.

One interesting finding in the results is that a paper-and-pencil test of affective involvement correlates with the data taken from brain imaging. The combined analysis of choice, paper-and-pencil measures, and blood flowing through various parts of the brain is a step forward in the validation of research and theory building by academics.

## Future research

Given the importance of brands and the related work on attitude toward the brand, one might wonder if there is attitude transfer from the aesthetic package to the brand itself. For example, does the success of Coca-Cola rely on its unique packages and does its focus on the creativity of new packages help keep the equity of the brand? Perhaps people are intrinsically attracted to the package and hence infer what they are attracted to is rewarding, even though the product itself is actually not rewarding to the individual. There might be a positive build up of attitude toward the brand, through the aesthetics triggering reward in the brain.

One important way to extend the results of this research is to further manipulate the product package design itself. Unity and prototypicality are shown to be overriding factors in choice and evaluation of products (Veryzer & Hutchinson, 1998). As such, future research could investigate reaction times, choices, and reward values integrating these features as well as other design factors such as color and textures. Another possible area for future research stems from Bloch et al. (2003) inclusion of individual differences in consumers' aesthetic experiences. Specifically, the authors' concept of centrality of visual product aesthetics as an individual difference measure could soak up variance in the reaction times and the actual choices. Further research could also investigate whether urging for aesthetic product is consistent over time or mainly serves short-term variety seeking. For example, Menon and Kahn (1995) argue that one reason consumers seek variety in product choices is to satisfy their need for stimulation. Moreover, future research could further investigate reaction time differences between the

phases of product presentation, price presentation, and choice. Experiments in this study were set up in such a way that data did not reveal whether more time is spent at presentation, during choice, or during both phases. Finally, future investigators could also analyze potential relationships between brain areas. For example, researchers could conduct connectivity analyses to find out whether both the ventromedial prefrontal cortex and the striatum are differentially activated for the aesthetic package designs during initial presentation.

### Managerial implications

Product differentiation by design is an important lever for marketing managers in order to set the offering apart from competition. The findings of this research imply unknown brands differentiated by aesthetic packaging design have the opportunity to be the first choice of customers, even if the well-known, branded product presents a huge competition. Differentiation by aesthetic packaging design triggers reward – that is, customers wanting the product – and choice, despite its lack of brand awareness and brand reputation. This is important for store brands that typically do not focus on packaging, but a lower price. Our results also help to explain why sales of “no name” brands in bland packaging, sold at low price, improved significantly when their packaging was changed to show pictures of the food products in bright appetizing colors. Strong brands should not only rely on brand strength but on differentiation by aesthetics as well. A prime example of distinctive packaging is the shape for the Coca-Cola bottle. This trademarked shape is one of the prime factors in warding off retail store brands of colas as they are the only curved shaped bottle on the shelf.

In summary, one way to quickly differentiate from competitors, without altering the core offering, is to change the package. Relevant levers of aesthetic packaging design are individual components such as color, luminance, shape, and texture. Taken together, these components may create an aesthetic product impression (Orth & Malkewitz, 2008). However, since recognition benefits of certain packages may exist, marketers should balance the benefits of changing to the package design against possible consumer confusion or annoyance of not being able to immediately select their well-known brand. Together, this research speaks extensively to the diverse community involved in aesthetics and consumption. Even though our research might raise a new set of questions, we believe that meaningful answers have been provided, benefiting future package design, management, and research.

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## Appendix A

### A.1. FMRI data collection

Brain scanning was performed on a 1.5-Tesla Avanto scanner (Siemens, Erlangen, Germany) using a standard eight channel head coil. A total of 1120 volumes were acquired. The slices were axially oriented along the AC-PC line with an interleaved acquisition order and whole brain coverage. Scan parameters were number of slices: 33; slice thickness: 2 mm; matrix size: 64×64; field of view: 192 mm; echo time (TE): 50 ms; repetition time (TR): 2.91 s, flip angle: 90°.

### A.2. FMRI data analysis

FMRI data analysis was performed using Statistical Parametric Mapping 5 (SPM5, <http://www.fil.ion.ucl.ac.uk/spm/>). Pre-processing included realignment with unwarping, normalization to the canonical EPI-template used in SPM5, and smoothing with an 8-mm Gaussian kernel. The images were resampled to a voxel size of 3×3×3 mm. For modeling the blood oxygen level dependence (BOLD) response, the data were entered into a general linear model (GLM) for each subject. For each session, the following events were defined: (1) product category, (2–5) product picture for the four configurations: aesthetic packaging design and well-known brand, aesthetic packaging design and unknown brand, standardized packaging design and well-known brand, and standardized packaging design and unknown brand, (6–9) price for the four configurations in the high price condition, (10–13) price for the four configurations in the low price condition, (14) positive buying decision, (15) negative buying decision. The onset times of each event were convolved by the canonical hemodynamic response function used in SPM5 and the temporal derivative. Parameter images for the respective contrasts of interest were generated for each subject and were then subjected to a second-level random effects analysis using a full-factorial design with the factors packaging design (two levels: aesthetic/standardized) and brand (two levels: well-known/unknown). Statistical threshold was set at a *p*-value of .001 voxelwise (uncorrected for multiple comparisons) with a cluster size threshold of ten voxels.

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