Perceptual fluency in interior design: a study towards the effects of minimalistic and gestalt interior design on users experiences

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In this study, perceptual fluency, the ease with which sensory information can be processed, is introduced into environmental appraisal theory. Several studies showed that perceptual fluency evokes positive affect and thereby guides an aesthetic judgment for a given stimulus. Moreover, it is theorized that this relation between positive affect and aesthetic judgment is moderated by higher levels of processing. The easier a given stimulus can be perceived, the greater is the evoked perceptual fluency. Therefore several studies suggest that positive affect and the preference judgment are influenced by information reducing concepts, such as minimalism and Gestalt principles. This reasoning is tested in two experiments using contemporary interior design pictures. The results of experiment one do support the relation between minimalistic design and positive affect. Experiment two supports the view that higher levels of processing do over rule lower level processing and thereby influence positive affect. There was, however, no hard empirical data found that this positive affect was evoked by perceptual fluency.

When we are awake, we are always confronted with our visual environment. Even if we are not aware of it, the environment influences our behavior. When confronted with the visual environment, we try to make sense of it. But how do we do this?

Habitat theory (derived from Orians (1980) savanna theory) states that human preference to natural environments is elicited by specific types of configurations characteristic of environments that were most favorable to pre-modern humans from the standpoint of yielding food and drinking water (Berg, 2004; Joye, 2007). This would explain why people prefer visual natural environments (e.g. Stamps, 2004) or visual urban environments that resemble the savanna (e.g. Joye, 2007). The model of Ulrich (1983) suggests that a rapid response to an environment triggers a general like-dislike affect which is independent of, and primary to, cognition. People use this affect as a guide for their preference judgment. The like-dislike affect is influenced by features such as: gross structural aspects of settings; gross depth properties requiring little inference; and general classes of environmental content (e.g. vegetation, water). One of the problems with this model is that the features are too vague and therefore lack predictability. The Kaplan (1987) model contradicts the Ulrich (1983) model in arguing that there is a broad range of involvement of cognitive processes in preference judgments. Moreover, he proposes that the judgmental process is guided by the need to explore and the need to understand. Therefore, the preference judgment of visual environments is influenced by features as complexity, mystery, coherence & legibility. However, although the model has been used widely, it lacks consistent empirical evidence (Stamps, 2004).

Another problem with the models mentioned before is that they assume there is a particular type of environment, composed of a particular arrangement of elements, which are most adaptive for humans (Parsons, 1991). However, this reasoning does not seem to make sense when considering that during evolution, humans also changed their habitat (Kahn, 1999). Therefore a more flexible system would be a major adaptation for humans. Moreover, Balling & Falk (1982) found that children preferred savanna environments over other more western natural environments. However, mid-adolescents and adults had an equal preference for both environments. This suggests a learned preference for western natural environments, which in turn argues for a more flexible appraisal system. For those reasons, this paper argues for a more general processing system that allows for a wide array of environmental settings.

Most evidence supporting these models comes from studies which compare the effects of environments among natural settings or between natural and urban settings (e.g. Stamps, 2004). However, most people nowadays spend most of their time in urban environments and not in natural settings. More specific, people spend most of their time at work and at home, that is: inside nowadays buildings. When a model explains visual environmental perception (or preference) it should also predict concepts as interior design; the design of the inside of buildings. Not only because such a model would offer more practical implications but also because a model which predicts preference judgments for both 'evolutionary' environments (such as natural settings) and contemporary environments (such as living rooms), can be regarded as robust.

Then, what model can explain visual environmental appraisal? From a conscious cognitive perspective, people could deliberately evaluate each part of the environment and after balancing all pros and cons come to an evaluative judgment. Such an approach of deliberate evaluation would cost a vast amount of time and energy. From an evolutionary perspective, a system that requires minimal processing to come to a quick judgment about the environment would be a major evolutionary advantage (Parsons, 1991). In fact, it has been found by Korpela, Klemettilä, & Hietanen (2002; 2004) that people make such a quick judgments. This raises the question of what underlies such quick preferential judgments. The main thesis of Reber, Schwarz, & Winkielman (2004) offers a solution. They regard the preference judgment as a function of the perceiver's processing dynamics: the more fluently the perceiver can process an object, the more positive is one's response.

Outline of the paper

The aim of this paper is to combine the processing fluency theory and the models for visual environmental preference. More specific, the proposed model aims at explaining the perception of interior design inside buildings. Therefore, first the processing fluency theory is introduced. Thereafter, the focus is on how perceptual fluency guides the perception of environments. In the first experiment, the main proposal that certain environments evoke a positive affect is tested. In the second experiment, the missing links of the first experiment; perceptual fluency, Gestalt psychology and the relation between perceptual fluency and intuitive judgments, will be tested. Thereafter, the implications of the discrepancy between the two experiments will be discussed.

PROCESSING FLUENCY

The basics of processing fluency and its effects on human thoughts lie in the reasoning that people do not solely rely on the content of their thoughts, but also on metacognitive experiences of the processing of these 'thoughts' (Alter & Oppenheimer, 2009). A high fluency, as opposed to a low fluency, is regarded as something positive because it is informative of a positive state within the cognitive system or the outer world (Winkielman, Schwarz, & Fazendeiro, 2003). On the contrary, low processing fluency is associated with a negative state. As these positive and negative states suggest, it is not the fluency experience itself that evokes the preference. Winkielman & Cacioppo (2001) found in their research that high processing fluency evoked positive affect. Therefore, it was argued that the affective response mediated the relation between processing fluency and judgments (Winkielman et al., 2003). This is what has been found by Winkielman et al. (2003); processing fluency, which may or may not be experienced consciously, immediately lead to an affective reaction.

This rapid, immediately affective reaction connects to the finding that participants made preference judgments rapidly and easily and tend to be unaware of what variables predicted their preference (Kaplan, 1987). This view is also supported in its affective nature by Ulrich (1983), Gifford (2007) and Hartig & Evans (1993), and is rather consistent with evidence from processing fluency. Processing fluency may emerge at early stages of stimulus processing and precedes the recognition of specific features Winkielman et al. (2003). Due to the nature of affect, a negative or positive value that is given to a situation or stimulus, affect seems rather fitting to convey such a message. Korpela et al. (2002; 2004) showed in their studies that different environments enhanced a rapid (200 ms) affective response and thereby an appraisal judgment.

Schwarz et al. (1991) showed that processing fluency evokes a judgment of a given stimulus, independently of its content. According to the review of Alter & Oppenheimer (2009) processing fluency can be evoked by many means. This variety of processing fluency evoking stimuli can be characterized on a dimension ranging from perceptual fluency to conceptual fluency. The perceptual level of fluency "reflects the ease of low-level, data driven operations that deal primarily with 'surface' features of stimulus, or its perceptual form" (Winkielman et al., 2003, p. 6). Perceptual fluency can be regarded as the most primitive processing fluency; it is evoked right after people perceive a given stimulus. Although visual fluency has gained most attention (e.g. Reber, Winkielman, & Schwarz, 1998), this can be any sensory modality. Conceptual fluency, at the other end of the processing fluency spectrum, is regarded as the ease with which a given concept can be processed. This involves higher cognitive processing and therefore conceptual fluency can be regarded as the most elaborative processing fluency. This dimension from perceptual to conceptual fluency, derived from the model of Ortony, Norman, & Revelle (2004), regards human functioning as a product of the interplay between three levels of processing. The visceral (c.f. perceptual fluency), routine and reflective (c.f. conceptual fluency) levels represent the (evolutionary chronological) biological origins of the brain. Similar reasoning can be found in the environmental preference model of Kaplan (1987), in which he distinguishes immediate from inferred or predicted levels of predictors. Note that the level in between (i.e. routine) in the Ortony et al. (2004) model is not explicitly appointed in the processing fluency spectrum; however processing fluency by means of, for instance, mere exposure (e.g. Reber, Schwarz et al., 2004) could be an example of this level.

Because the aim of this paper is to create a model which explains the relation between the visual environment and the human appraisal of it, perceptual fluency is of particular interest. However, some models adopt the duration of presentation (c.f. Winkielman et al., 2003), repetition of presentation or visual priming as part of perceptual fluency. These factors imply some kind of interaction between human and environment. Although these means will probably influence environmental appraisal, this is not the aim of this paper. Therefore, this paper adopts the categorization of Alter & Oppenheimer (2009), in which the focus is at physical perceptual fluency and temporal perceptual fluency (i.e. duration, repetition and priming) will be ignored. When mentioning perceptual fluency, physical perceptual fluency is meant.

The concept of perceptual fluency is based on the simple observation that the processing of any visual stimulus requires sensory work. The amount of sensory work needed is reflected in the speed and accuracy of visual processing as well (Winkielman, Schwarz, Reber, & Fazendeiro, 2000). An environment which is easy to perceive would lead to positive affect, which in turn leads to liking. This raises the question of what makes visual environments easy to perceive. Reber, Schwarz et al. (2004) argue that the information rate (i.e. the amount of information) is an important predictor of the fluency with which a stimulus can be perceived. That is, when the information rate is reduced, the ease to perceive the stimulus will increase. One way to reduce information rate in the environment is by means of minimalistic design; omitting elements from the scenery. Another way is by means of using Gestalt psychology.

GESTALT PSYCHOLOGY

Minimalism (or simplicity) is the art of omitting. When the information rate is low, it is easier to focus on the information that is left over. Therefore it is theorized that minimalism evokes perceptual fluency and thereby positive affect, which on its turn influences the aesthetic judgment (Reber, Schwarz et al., 2004). Natural environments have been identified as possessing lower levels of complexity (or high levels of simplicity) than urban environments (Wohlwill, 1976). Therefore, the findings that natural environments evoke positive affect as opposed to urban environments (Korpela et al., 2002) and are preferred over urban environments (Stamps, 2004), support the reasoning that simplicity evokes processing fluency. It is not surprising that simplicity has been linked to beauty and users experience (Karvonen, 2000). Moreover, Kaplan (1987) adopts complexity as an immediately available factor for predicting preferences. Simplicity is also indicated as one of the fundaments of Gestalt psychology; the Gestalt principle of good figure (Prägnanz) is also called the law of simplicity. Moreover, a simpler and more stable figure is considered a 'good' figure (Wong & Sun, 2006). Kaplan (1987) referred to this 'hanging together' of an image as coherence; the ease with which the information in the scene can be organized into a relatively small number of chunks.

According to Gestalt psychology, stimuli isomorphic to physiological mechanisms are easy to process and are rated as 'good figures' (Reber, Schwarz et al., 2004). Gestalt psychology has identified a series of these physiological mechanisms with which humans are 'equipped' to create a holistic view of their world (or environment). These physiological mechanisms can be traced back to objective features in a given stimuli by means of contrasting perception with reason. Therefore, it has been argued that these 'identified' objective features of stimuli in fact contribute to processing fluency and thereby are being identified as feature of beauty (Reber, Schwarz, & Winkielman, 2004); Winkielman et al., 2000). These objective features are better known as the Gestalt principles of figure-ground, symmetry, similarity, proximity, continuation, and closure. Because these Gestalt principles facilitate the grouping of elements one way or another (figure-ground forms an exception), these principles reduce the information rate in an environment which needs to be processed. Therefore, it is argued that the Gestalt principles facilitate perceptual fluency and thereby creates a positive affect which in turn influences the liking judgments.

The principle figure-ground is better known as contrast between colors. When the contrast between stimuli is high, it is easy to perceive the distinct stimuli, as opposed to low contrast which makes it harder to distinguish stimuli from one another. Figure-ground can be manipulated by means of, for instance, the hue, saturation, and brightness of a color. An example of figure-ground alterations in interior design is the usage of light. In bright white light, it is not hard to distinguish different kind of objects. Yellow light, however, makes it harder to distinguish different objects because they look more alike in color.

Recognition speed, a standard measure of fluency, is faster for stimuli high in figure-ground contrast (Checkosky & Whitlock, 1973; Reber, Wurtz, & Zimmermann, 2004). The higher the contrast, stimuli were judged as more pretty, and less ugly (Reber et al., 1998). If figure-ground evokes perceptual fluency and thereby a preference, figure-ground contrast should be most influential during short presentation. This reasoning is supported; figure-ground contrast only influences aesthetic judgments at short exposure durations, but not at the duration of 10 seconds (Reber & Schwarz, 2002). Figure-ground also influences judgments in a way that would be expected of a perceptual fluency manipulator (for a review, see: Alter & Oppenheimer (2009)). Therefore, it has been argued that figure-ground facilitates perceptual fluency (Reber, Schwarz et al., 2004).

The symmetry principle 'causes' the mind to group elements which are placed mirror wise. The stimulus does not necessarily have to be the same color, shape or size as its mirror image to create symmetry; what matters is its relative position to one or more virtual axis (or mirrors). An example of symmetry in interior design is the placement of a table with some flowers on it on both sides of a couch.

Basic stimuli symmetry has been associated with the ease with which humans understand an image (Biederman, 1987). Visual areas in software demonstrating symmetry tend to be seen as a distinct figure (Wong & Sun, 2006). In the context of architectural facades, symmetry has been found to be strongly negatively correlated with complexity (Chipman, 1977; Heath, Smith, & Lim, 2000; Stamps, 1998). Moreover, symmetry has been linked to beauty in the context of human faces (e.g. Rhodes, 2006) and graphics (Purchase, 2002). Therefore, it has been argued that symmetry facilitates perceptual fluency (Reber, 2003; (Reber, Schwarz, & Winkielman, 2004).

There is evidence that the figure-ground and symmetry principles in design of stimuli evoke perceptual fluency and thereby influence judgments. Although there is less empirical evidence for similarity, proximity, continuation, and closure, this thesis follows the arguing that Gestalt principles in general reduce the information rate in stimuli design in a similar way (Reber, Schwarz, & Winkielman, 2004) and therefore argues that each of these principles reduce the information rate.

The principle of similarity 'causes' the mind to group similar elements (or not). This similarity can be based on any characteristic of stimuli; well-known examples are color, shape and size. An example of similarity in interior design is the usage of similar colors for chairs and couches. The proximity principle works in a similar way as similarity; spatial distance between elements 'causes' the mind to group elements (or not). Stimuli placed near each other are grouped together as opposed to stimuli placed distant from each other. An example of proximity in interior design is the distant placing of furniture in the living part of a room from the eating part of the room. On the contrary, within the different parts of the room, furniture is placed close together.

The principle of continuation 'causes' the mind to continue patterns rather than to perceive them as separate entities. In visual environmental perception, this causes humans to see 'crossing lines' when two lines seem to cross each other, instead of four line parts coming together in one point, thereby, continuation 'groups' together patterns. An example of continuation in interior design is a door with a lot of tiny windows; the wooden slats separating the windows seem to cross each other and form a raster. This principle is supported by the finding of Bar & Neta (2006) that people prefer curved visual objects over angular visual objects. That is, the edges of curved objects can be perceived as a continuation of a pattern, as opposed to angular objects, of which the edges will be perceived more as separate entities of patterns.

The closure principle works in a similar way as the continuation principle; the human mind tends to fill in the missing areas in incomplete figures. This, for instance, is the reason why humans still perceive an object while it is placed partly behind some other object. Or when people look through a window and their view is partly blocked by wooden slats separating the windows, people still perceive the holistic view of 'outside'. Perceiving problems occur when the 'holes' between two entities become too wide; then people cannot close the whole and therefore experience difficulty in perceiving.

AESTHETIC JUDGEMENT

Until this far, it is theorized that processing fluency causes positive affect. Moreover, this affect is used as an indication for a judgment, in the case of the visual environment; an aesthetic judgment (note the resemblance with the 'affect infusion model' (Forgas, 1995)). However, the model of Ortony et al., (2004) nuances this view. That is, the perceptual fluency – affect – aesthetic judgment relation holds at the most basic level of human functioning (c.f. visceral level (Ortony et al., 2004)). Norman (2005) refers to an aesthetic judgment at this level as appraisal, which comes rather quick and could be explained as a gut feeling or intuition. However, when people have more time to come to a judgment and thereby are allowed to 'think' about their aesthetic judgment, conceptual fluency (c.f. reflective level (Ortony et al., 2004)) comes into play. Stated else; the gut feeling can be nuanced by reasoning. Norman (2005) refers to this aesthetic judgment as beauty, wherein people base their judgment on what they are learned, what their culture tells them and what their neighbors say. As Norman (2005) puts out; things as abstract art must be learned by people (at reflective level), before they can prefer it over their appraisal at visceral level. This reasoning is supported in the model of Kaplan (1987), in which he distinguishes between immediate and inferred or predicted factors for preference. (So, the factors legibility and mystery (Kaplan, 1987) would influence preference only at the level of conceptual fluency. However, further examination of this reasoning goes beyond the scope of this thesis.) A difference in aesthetic judgment by means of direct impression and cognitive reasoning is supported by the neurological work of Buck (1999), who identifies different systems for knowledge-by-acquaintance and knowledge-by-descriptions. Parsons (1991) also identifies two affective pathways; one based on the amygdale, and the other on the hippocampus, which correspond to this reasoning.

In the Winkielman et al. (2000) study, people had to rate pictures preceded by words on their aesthetic appeal. In one condition, people were misled and told that the positive feeling they might experience, was evoked by music which was played during the experiment. Participants 'misattributed' their affect and did not make us of affect as indicator for their aesthetic judgment, as opposed to the people in the normal condition. This supports the view that is possible to suppress affect evoked by perceptual fluency as guidance by cognition. Moreover, Halberstadt & Hooton (2008) found that the aesthetic rating of paintings based on gut feeling correlated significantly with the processing fluency measure recognition time, as opposed to aesthetic ratings of paintings, based on reason, which did not correlate significantly. Differences in aesthetic judgment occur because people are typically unaware of what caused the perceptual fluency Winkielman et al. (2000). When people use cognition to come to aesthetic judgment, higher cognition factors interfere with the perceptual-fluency-affect-judgment relation and cause a difference between judgments.

SUMMARY

The reasoning of perceptual fluency can be rather consistent with the earlier mentioned evolutionary advantages of human species who gain a system that enables them to rapidly judge the environment. That is, it allows for;

- a rapid evaluation of the environment, as suggested by the results of Korpela et al.

(2002; 2004);

- an affective response that acts as a guide for preference as suggested by Korpela et al. (2002; 2004) and Ulrich (1983);
- some cognitive elaboration of the offered stimuli (Kaplan, 1987);
- gross features (i.e. Gestalt principles) which predict whether environment will enhance preference (Ulrich, 1983; Kaplan, 1987);
- and a distinction between universal attraction and learned or cultural beauty (Ulrich, 1983; Kaplan, 1987).

EXPERIMENT 1

The thesis of the first experiment is whether Gestalt principles in visual interior design facilitates positive affect. To test this thesis the affective priming paradigm (APP) is used. The APP allows for measurement of affective responses at an automatic level. In the APP, presentation of an attended and overtly evaluated affective target stimulus (in this study; words) is preceded by another affective primer stimulus (in this study; images of interior design of living rooms, which differed in the information rate offered, based on Gestalt). This primer stimulus evokes a certain amount of perceptual fluency and thereby certain affect. The participants are supposed to evaluate the affective target stimulus on its category (i.e. positive or negative) by pressing one of two buttons. In studies using the APP, affectively congruent prime-target pairs typically result in shorter reaction times to targets (positive- negative evaluative decisions) than affectively incongruent prime-target pairs. This difference in reaction time and accuracy is regarded as an indication of a certain affective reaction.

The first prediction is that a picture of a living room high in Gestalt evokes perceptual fluency and thereby a positive affect (i.e. feeling). Therefore it is predicted that:

H1 participants react faster to positive targets (words) than to negative targets (words) which are proceeded by images of a living room high in Gestalt.

Second, because Gestalt in environments enhances perceptual fluency and thereby positive affect, the absence of Gestalt in environments will cause an absence of perceptual fluency and an absence of positive affect. Therefore it is predicted that

H2 participants react faster to positive targets (words) proceeded by images of a living room high on Gestalt principles than to positive targets proceeded by images of a living room low on Gestalt principles.

Methods experiment 1

Participants

18 participants participated in the experiment on a voluntary basis or were rewarded a course credit. 9 of them were female, 9 were male. Their age ranged from 18 to 22 years (M = 20.22, SD = 1.26). The participants were native speakers of Dutch (except one who was German but indicated having no difficulty in understanding Dutch) had normal or corrected-to-normal vision and were all right handed. All participants did not take part in the pretest and were unaware of the purpose of the experiment.

Stimuli

The experiment was designed in the computer program E-Prime v1.1. The stimulus presentation and data collection were controlled with E-Run. The program was run on a Toshiba Satellite Pro 2100 laptop Intel Pentium 4. The operational system was Windows XP professional service pack 3. The monitor had a 14.1 in. screen, a 1024x768 resolution and a reported 60 Hz display refresh rate. Measurements of E-Prime reported a mean refresh rate of 59.98 Hz (SD = 0.54).

Because the aim of this thesis is to test the perceptual fluency theory in nowadays environmental settings, pictures were selected on basis of their representativeness of nowadays, common, interior design living rooms. The initial set of 34 pictures from living rooms, which were retrieved from flickr.com, was rated by independent judges (n = 12), who were unfamiliar with the scope of these pictures. Half of the judges were instructed to count the number of unique information items (as indicator for the information rate) and the other half had to count the number of groups of information shown in the pictures. Purpose was to keep the information rate relatively equal among the pictures in order to measure Gestalt principles, instead of the information rate. The number of groups was counted to estimate the amount of Gestalt principles; people use Gestalt principles to group information together. Subsequently, from the initial sample of 34 pictures, all pictures with a mean information rate value below and above one *SD* of the group mean were excluded (M = 46.43, SD = 19.75). This resulted in a selection of 16 pictures. Of this sample, 4 pictures (2 high in Gestalt, 2 low in Gestalt) were excluded on the basis of resolution, and number of rooms which were visible. This resulted in 6 pictures low (M = 8.59, SD = 3.07) on Gestalt and 6 pictures high on Gestalt (M = 15.87, SD 6.41) (see Figure 1 to 4 for examples). Two pictures in the low Gestalt group included a television, which was turned on. To eliminate any possible effect of the view visible on the television; the pictures were manipulated using the computer program Adobe Photoshop CS4 so that the televisions were 'turned off'. The pictures were presented full screen and fit to the resolution of 1024x768.

The target category words were the Dutch translation of the positive words; happy, love, fun, cheerful, nice, and fortunate (blij, liefde, plezier, vrolijk, aardig and gelukkig) and the negative words; wrong, anger, grief, aversion, fear, and unfortunate (fout, woede, verdriet, afkeer, angst and ongelukkig). Both series of Dutch words have a mean character length of 6.33 (SD_{pos} = 1.36 and SD_{neg} = 2.25). The words were rated by judges (n = 3) and found to be indicating their valence category unambiguous. The words were presented in the center of the screen, had the font 'Verdana', were black colored and had a point size of 15. The background color was grey (which was also the background color during the whole experiment).

Design and procedure

Participants were welcomed by the experimenter and asked to take place behind the computer. There they were explained they would evaluate certain stimuli in an experiment called 'the learning environment'. In order to evaluate the stimulus (target category words), participants were asked to put their index fingers on the 'z' and '/' key. For half of the participants the first key was linked to positive evaluations and the latter to negative evaluations. This order was counterbalanced for the other half of the participants to exclude influences of the body –specificity hypothesis (Casasanto, 2009). Participants were told that they were allowed to move the laptop so they could easily respond and watch the screen. The first task was to get familiar with the evaluative task. Therefore, the participants were required to judge one random series of the twelve target category words as accurate and as fast as possible. Each word was guided with a feedback display. The second task was almost identical to the first task and acquired the baseline of data. The two differences were that the participants had to judge two random series of the twelve target category words (n = 24) and the feedback display after each word was omitted.

The real experiment, the third task, had a 2 (Gestalt: low or high) x 2 (target category words: negative or positive) within subject design in which reaction time and correct response were the independent variables. The participants were offered a random order of all combinations of the 12 pictures of living rooms with the 12 target category words (n = 144), thereby creating 4 groups of items (n = 36): two congruent (low negative and high positive) and two incongruent (low positive and high negative). A single trial of the experiment consisted of the following events. First a full screen picture of a living room was shown for 300 ms. Then, directly after the picture 'disappeared' the target category word was shown until the participant had responded. Participants had to rate whether the target category word was a positive or negative word by pressing either the 'z' key or the '/' key. Fi-

Figure 1 & 2 - examples of pictures high in Gestalt

Figure 3 & 4 - examples of pictures low in Gestalt

nally, a grey screen was shown for 1 second before a new trial started.

Thereafter the participants had to open an envelope next to the laptop which contained three additional paper tasks. The first was a Dutch translation of the PANAS (Watson, Clark, & Tellegen, 1988). In the second task, the participants were asked to rate twelve A4 printed pictures of the living rooms which were presented during the experiment on their aesthetic value on a 5 point scale. The last task consisted of filling out some demographic values. Hereafter they were thanked by the experimenter and explained what the real purpose of the experiment was about.

Results experiment 1

After rejecting incorrect responses and responses with response times exceeding the time window of individual mean response time +/- two standard deviations, mean response time in each stimulus condition was calculated for each participant. The mean response accuracy for each group is shown in Table 1.

The response time data were analyzed by a 2 x 2 ANOVA with Gestalt (low vs. high) and target category (negative vs. positive) as within-subject factors. Since none of the covariates (demographic values and positive or negative feelings) did not correlate to the dependent variable, none of the theorized covariates were adopted. The main effect of Gestalt and target were not significant. The effect of priming was statistically significant, as shown by a significant ANOVA interaction term between the main effects of Gestalt and target category (F (1, 17) = 6.85, p = 0.02, η^2 = 0.28). Paired comparisons showed that after the presentation of a living room high in Gestalt, the response time to positive words is significantly lower as compared to negative words. Subsequently, the response times to a positive target category after the presentation of a picture of a living room high in Gestalt than after a picture of a living room low in Gestalt differ significantly from each other (see Table 2 and Figure 5).

In addition, the relation between the aesthetic judgment and the response time data was analyzed in a Pearson bivariate correlation analysis. The results showed that there was no significant correlation between aesthetic judgment and response time data (n = 18, p = 0.93). Furthermore, a paired sample t-test showed that there was no significant difference in aesthetic judg-

Table 1 - Mean response accuracy on the APP for different picture groups

	Positive		Negative	
Pictures	*M*	*SD*	*M*	*SD*
Low Gestalt	93.7%	5.3%	90.6%	4.9%
High Gestalt	93.5%	3.8%	92.8%	4.4%

Table 2 - confidence intervals different picture groups

	Negative		Positive		
	M	*SD*	*M*	*SD*	*CI*
Low Gestalt	586.10	49.52	598.49	62.23	
High Gestalt	601.28	65.21	577.74	68.64	7.69, 39.40 **
CI			4.08, 37.41 *		

* = < 0.05, ** = < 0.01

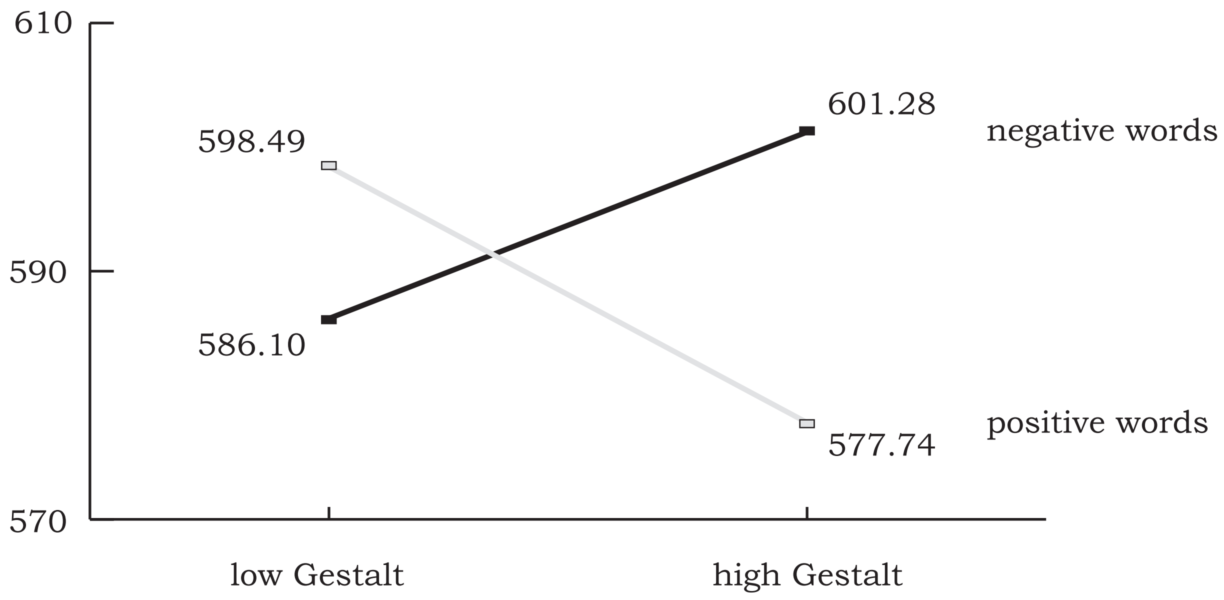

Figure 5 - word valence x gestalt picture. The differences between the high Gestalt pictures followed by either a negative word or a positive word and between high and low Gestalt pictures followed by a positive word are significant (respectively $p < 0.01$, $p < 0.05$).

ment between the low and high Gestalt pictures (t (17) = -0.97, p = 0.35 (two-tailed)).

Discussion experiment 1

The results of a difference between positive and negative words proceeded by an environment high in Gestalt suggest that the negative words create incongruence with positive affect which is evoked by the Gestalt principles. On the contrary, positive words are in congruence with positive affect evoked by the Gestalt principles. This supports the first hypothesis (*H1*) that the use of Gestalt principles in interior design evokes perceptual fluency and thereby creates a positive feeling. The difference in reaction times of positive words preceded by either environments low or high in Gestalt supports the vision that environments low in Gestalt does not evoke positive affect. That is, the absence of positive affect creates incongruence with the positive words offered. On the contrary, the positive affect enhanced by the environment high in Gestalt is in congruence with the positive target words and thereby facilitates a shorter reaction time. This supports the second hypothesis (*H2*). Moreover, the analysis of the aesthetic judgment data and response time supports the thesis that the initial positive affect based on the perceptual fluency does not correlate to a deliberate preference or so called aesthetic value.

Although experiment 1 provides evidence that pictures of interiors high in Gestalt (as opposed to pictures low in Gestalt) evoke perceptual fluency and thereby a positive affect which is not related to the aesthetic judgment, hard data is missing to support several theoretical claims. The priming pictures were presented fit to the screen resolution of 1024x768. Because 4 of 6 pictures in the low Gestalt group had a resolution of about 1152x768, the effect of fit to resolution on presentation of these pictures was that the width of these pictures was decreased with about 11%. On the contrary, all of the high Gestalt pictures had a resolution of 1024x768 (or a proportional resolution) and were therefore shown 'in proportion'. Although the '1152x768 pictures' do not look strange, the explanation that the 'fit to screen effect' caused the found difference in reaction times between picture-word pairs cannot be excluded, also because the two pictures in the low Gestalt group with a 1024x768 resolution (or proportioning) showed mixed results (picture 1: M_{neg} = 586.87, SD_{neg} = 65.46, M_{pos}

= 610.19, SD_{pos} = 79.88, picture 2: M_{neg} = 601.76, SD_{neg} = 57.17, M_{pos} = 584.95, SD_{pos} = 65.06). Important to note is that this problem only applies to the interaction effect that shows a difference in response time on positive words between low and high Gestalt pictures, not to the interaction effect that shows a difference in response time for high Gestalt pictures between positive and negative words.

Although the pictures used in the low and high in Gestalt groups differed in their amount of counted groups (i.e. Gestalt), these pictures also differed in their information rate. The pictures high in Gestalt are low in unique items (M = 35.93, SD = 27.45) and the photos low in Gestalt are high in unique items (M = 61.57, SD = 48.04). Therefore the only conclusion that can be drawn upon this topic is that a low information rate (unique items or by Gestalt principles) in interior design pictures evoke positive affect as opposed to a high information rate.

Also, the experiment does not provide direct evidence that this relation is mediated by perceptual fluency. That is, it is only theorized that the photographs evoke fluency because they contain less information (unique or by Gestalt principles), no measurement of ease or accuracy of the perceived pictures is offered. And last, although there is no relation between the affective responses, the response time and the aesthetic judgment of the picture, no evidence is provided that the usage or absence of conscious thought alters the aesthetic judgment.

EXPERIMENT 2

Experiment 2 was designed to provide empirical evidence to support the theoretical claims which were not supported by the data of experiment 1. The resolution problem is tackled by adapting the pictures to the 1024x768 resolution. This means that pictures not meeting these requirements will be cut to fit to one of the appropriate dimensions (either 1024 pixels in width or 768 pixels as in height) and therefore will not be fully presented. The Gestalt issue was countered by asking judges in the pretest to judge the interior design pictures specifically on the amount of Gestalt principles used. Because the Gestalt claim is not supported by empirical evidence from experiment 1, in experiment 2, the high or low Gestalt pictures from experiment 1 will be referred as respectively pictures low or high in information rate. The set of pictures tested in experiment 2 is composed of new pictures (low and high in Gestalt) and the pictures from experiment 1 (low and high in information rate).

To provide evidence that it was perceptual fluency that evoked positive affect, additional experiments needed to be conducted. The ease of perception is characterized by hard variables as the speed and accuracy by which a stimulus can be perceived. So logically, the ease of perceiving would translate itself into a shorter response times and greater accuracy of detection (is there anything?) and identification (what is it?) (Reber, Wurtz, & Zimmermann, 2004). Therefore, the experiment was extended with a detection and an identification task. In the detection task (c.f. Reber, Wurtz et al., 2004), participants were shown a picture of a living room or a white screen for 17 ms. The picture was preceded and followed by a different mask. It was up to the participants to indicate whether they saw a picture or a white screen. In the identification task (c.f. Reber, Wurtz et al., 2004), participants were shown a picture of a living room or a kitchen of a garage for 100 ms. It was up to the participants to indicate whether they saw a living room or not.

The aesthetic judgment difference argument was countered by adding a between subject design to the experiment (c.f. Halberstadt & Hooton, 2008). In one group, participants had to come to an aesthetic judgment as fast as possible. In the other group, participants were forced to think about their aesthetic judgment.

Pictures of a living room high in Gestalt or low in information rate (pictures from experiment 1), evokes perceptual fluency and thereby is detected quickly. Therefore it is predicted that:

H1 participants' reaction time in the detection task to pictures low in information rate (*H1a*) or high in Gestalt (*H1b*) is shorter than to pictures high in information rate and low in Gestalt.

Pictures of a living room high in Gestalt or low in information rate evoke perceptual fluency and therefore will be recognized as a living room more quickly. Therefore it is predicted that:

H2 participants' reaction time in the identification task to low in information rate (*H2a*) or high in Gestalt (*H2b*) is shorter than to pictures high in information rate and low in Gestalt.

The following two hypotheses (3 and 4) are similar to the hypotheses from experiment 1. Pictures of a living room high in Gestalt or low in information rate evoke perceptual fluency and thereby a positive affect. Therefore it is predicted that:

H3 participants react faster to positive targets (words) than to negative targets (words) which are proceeded by pictures of a living room low in information rate (*H3a*) or high in Gestalt (*H3b*).

Because Gestalt in environments enhances perceptual fluency and thereby positive affect, the absence of Gestalt or a high information rate in environments will cause an absence of perceptual fluency and an absence of positive affect. Therefore it is predicted that

H4 participants react faster to positive targets (words) proceeded by images of a living room low in information rate (*H4a*) or high in Gestalt (*H4b*) than to positive targets proceeded by images of a living room high in information rate (*H4a*) or low on Gestalt (*H4b*).

It is theorized that the amount of Gestalt and information rate used in environments evokes perceptual fluency and thereby guides the aesthetic judgments, only when this is based on gut feeling. Therefore it is predicted that:

H5 the reaction time to the stimuli pictures in the detection tasks is correlated with the aesthetic judgment for participants in the gut feeling group. For participants in the elaborative evaluation group, no such correlation exists.

Methods experiment 2

Experiment 2 can be regarded as an extension on experiment 1. Therefore, some procedures are the same and therefore there will sometimes be referred to experiment 1.

Participants

Twenty-four participants participated in the experiment on a voluntary base or were rewarded a course credit. 12 of them were female, 24 were male. Their age ranged from 18 to 29 years (M = 23.17, SD = 2.78). The participants were native speakers of Dutch, except four who were German but indicated having only minor problems in understanding Dutch, had normal or corrected-to-normal vision and were all right handed. None of the participants did take part in the pretest or experiment 1 and were unaware of the purpose of the experiment.

Stimuli

Experiment 2 was conducted with the same software on the same computer as in experiment 1.

From the initial set of pictures from experiment 1, one picture of each group was deleted because of their artificial appearance and to reduce the amount of stimuli in order to limit the total amount of demanding tasks for participants. Therefore the 'new' low and high in information rate groups had a mean of respectively 36.41 (SD = 26.79) and 61.11 (SD = 50.55). These pictures were scaled down to the 1024x768 resolution and cut to shape if necessary. The extra set of pictures was composed in a similar way as the pictures of experiment 1. Thereafter, an initial set of 36 pictures (also scaled down to 1024x768 resolution and cut to shape if necessary), retrieved from flickr.com, was rated by independent judges (n = 10), who were unfamiliar with the purpose of the pictures. To help the judges focus on the information rate instead of products or other 'meaningful entities', the pictures were blurred by means of the Adobe Photoshop CS4 sponge tool (settings: 0, 0, 15). Half of the judges were instructed to count the number of unique information items (as an indicator for information rate as in experiment 1). The other half was instructed carefully by means of a written explanation to rate the pictures on each Gestalt principle by means of a 7 point scale (ranging from -3 to 3). Subsequently, these Gestalt ratings were summed and sorted by their value. The 7 pictures with the highest and lowest Gestalt ratings were used to compose two sets of pictures (one low and one high in Gestalt) which did not differ in their total amount of information rate. This resulted in one group high in Gestalt (M = 47.92, SD = 6.84) and one group low in Gestalt (M = 49.95, SD = 3.50) which do not differ (t (10) = -.59, p = .57 (two-tailed)), see Figure 6 to 9. This total set of pictures, composed of 10 pictures from experiment 1, and 10 added Gestalt manipulation pictures, was used throughout the whole experiment in the detection task, identification task, the APP, and the aesthetic judgment task.

The images which were used in the detection task to mask the stimuli, were composed of parallel placed horizontal thin colored lines, created with the gradient tool editor in Adobe Photoshop CS4 (type: noise, roughness: 75%). The 'other pictures' in the identification task were pictures of typical garages and kitchens, which were retrieved from flickr.com. Because these pictures were not of further interest for analysis, these pictures were not judged by independent judges.

In order to evaluate words on their 'predictability', the difference between reaction times on pictures low and high in information rate for each word which were used in the APP as target in experiment 1, were calculated. By doing so, words were compared on their ability to predict pictures of both groups. Three words (1 positive; fun (plezier), 2 negative; anger (woede) and wrong (fout)) were omitted because these words showed no or a low difference between the different groups. To come to a set of 10 words, the negative word pain (pijn) was added. Therefore, the mean character length for the Dutch words was 6.2 (SD = 1.48) for the positive words and 6.6 (SD = 2.41) for the negative words.

Design and procedure

In contrast to the arguing above, the order of the detection task and identification task is opposite in the experiment (that is, it starts with the identification task). This is done so to avoid any recognition effects of the detection task on the identification task. The introduction was replicated from experiment 1. In the first task, the identification task, participants were shown a picture of an interior design for 100 ms Participants had to judge whether they saw a living room or an 'other' setting (garage or kitchen). Participants run 10 test trials on some meaningless semantic stimuli, before starting the real experiment. This consisted of 80 trials, wherein each picture (20 experimental, 20 'other') was shown twice. To avoid learning effects of when to respond, the onset time for each picture was either 800 ms or 1200 ms Subsequently, participants had to do a detection task in which either an experimental picture was shown or a white slide for 17 ms (is 1 refresh rate of the screen). To increase the difficulty of the task, before the picture or slide was shown a colored mask was shown for either 750 ms or 1250 ms. After the picture, a different colored mask was shown to indicate that the picture or slide had passed. Again, participants run 10 test trials on some meaningless visual stimuli. Thereafter, the real experiment consisted of 80 trials wherein each picture (20 experimental, 20 white slides) was shown twice.

Then the APP followed. Only this time, the base rate task was omitted. The 20 experimental pictures were combined with al 10 words, creating 200 trails. Then the participants were asked to rate the pictures on their aesthetic appeal on a 5 point scale as in experiment 1. Participants in the gut feeling condition were asked to report their judgment as fast as possible, based on their gut feeling. Moreover, the picture was shown on the computer for only 1.5 second, after which they had to report their judgment. Participants in the elaborative

Figure 6 & 7 - examples of pictures high in Gestalt

Figure 8 & 9 - examples of pictures low in Gestalt

judgment condition were shown a picture for at least 5 seconds. Thereafter they had to write down at least one reason why they either liked or disliked the picture, in order to force cognitive reasoning. After participants had done this, they had to rate the picture. Subsequently, for all participants the PANAS and a demographic questionnaire followed as in experiment 1.

Results experiment 2

After rejecting incorrect responses and responses with response times exceeding the time window of individual mean response time +/- two standard deviations, mean response time in each stimulus condition was calculated for each participant for the detection task, identification task and the APP. Since none of the covariates (demographic values and positive or negative feelings) correlated to the dependent variable on all tasks, none of the theorized covariates were adopted.

The mean response accuracy, grouped by means of pictures, in the detection and identification task are shown in Table 3.

The response time data of the detection task for both the information rate pictures (from experiment 1) and the Gestalt pictures were analyzed in the same paired samples t-test. There was a marginally significant difference between the pictures low (M = 513.08, SD = 94.93) and high (M = 495.26, SD = 105.38) in information rate (t (23) = 1.790, p = 0.09). There was also a marginally significant difference between the pictures low (M = 476.32, SD = 94.20) and high (M = 500.16, SD = 95.54) in Gestalt (t (23) = 1.94, p = 0.07). The absence of a significant finding does not support hypothesis *1a* and *1b*. Moreover, the directions of the marginal effects for both groups were in the reverse direction as was predicted.

The response time data of the identification task for both picture groups were also analyzed in a paired sample t-test. There was no significant difference between the

Table 3 - Mean response accuracy on the detection and identifaction task different picture groups

	Detection		Identification	
Pictures	*M*	*SD*	*M*	*SD*
Low IR	88.3%	32.2%	75.8%	42.9%
High IR	93.8%	24.3%	86.7%	34.1%
Low Gestalt	95.0%	21.8%	90.0%	30.1%
High Gestalt	92.9%	25.7%	87.5%	33.1%
Blank slides	89.9%	30.2%		
Other			88.9%	31.5%

IR = information rate

Table 4 - Mean response accuracy on the APP for different picture groups

	Positive		Negative	
Pictures	*M*	*SD*	*M*	*SD*
Low IR	89.7%	10.2%	89.0%	6.9%
High IR	90.8%	7.8%	88.8%	6.4%
Low Gestalt	90.5%	7.9%	87.7%	9.4%
High Gestalt	89.7%	8.5%	89.3%	7.7%

IR = information rate

information rate pictures (*t* (23) = 0.88, p = 0.39) or Gestalt pictures (*t* (23) = -0.83, p = 0.42). Therefore hypothesis *2a* and *2b* are not supported.

The mean response accuracy for pictures, grouped by picture group and word valence, is shown in Table 4. The response time data of the APP for both picture groups were analyzed by a 2 x 2 ANOVA with information rate or Gestalt (low vs. high) and target category (negative vs. positive) as within-subject factors. For the information rate pictures the main effect for picture was not significant. The main effect for word valence turned out to be significant (F (1, 23) = 9.96, p < 0.01, η^2 = 0.30). The positive words were rated quicker (*M* = 590.20, *SD* = 16.54, *CI* = 555.97, 624.42) than the negative words (*M* = 608.17, *SD* = 17.87, *CI* = 571.20, 645.14). The interaction effect, which was supported by evidence from experiment 1, turned out to be not significant (F (1, 23) = 0.01, p = 0.93). A similar pattern was found for the Gestalt pictures: the main effect for pictures was not significant, the main effect for word valence was significant (F (1, 23) = 7.42, p = 0.01, η^2 = 0.24). The interaction affect turned out to be not significant (F (1, 23) = 1.30, p = 0.27). Therefore, hypothesis *3a, 3b, 4a* and *4b* are not supported.

Although the detection task did not find any significant effect, the relation between reaction time and aesthetic judgment was investigated. To do so, the mean response time data for the information rate and Gestalt pictures were correlated with the aesthetic judgment data of these pictures. Subsequently, the data set was split into a gut feeling and an elaborative reasoning group to compare the groups and was analyzed in a in a Pearson bivariate correlation analysis. There was no difference in correlation between the two groups for the information rate pictures (gut feeling: n = 11, p = 0.49 and elaborative reasoning: n = 12, p = 0.56) and Gestalt pictures (gut feeling: n = 11, p = 0.60 and elaborative reasoning: n = 12, p = 0.43). Therefore, hypothesis *5* is not supported. Further analysis showed that there was no difference in aesthetic judgment between the two rating groups (*t* (21) = 0.92, p = 0.37 (two-tailed)). Also, equal ratings for the information rate pictures were found (*t* (22) = -0.56, p = 0.58). Pictures high in Gestalt (*M* = 3.50, *SD* = 0.73) were rated as more beautiful than pictures low in Gestalt (*M* = 2.50, *SD* = 0.46, *t* (22) = 5.88, p < 0.01), regardless the aesthetic judgment group. Note that, due to a registration error, the aesthetic judgment data of one participant in the gut feeling group was missing.

Discussion experiment 2

The results of the second experiment reject all hypotheses. A simple explanation would be that the perceptual fluency in interior design thesis is falsified. However, a close examination of the relation between methods and data offers a nuanced view.

In the detection task, a picture was masked before and afterwards by a picture composed of thin colored lines. Because the picture is shown in combination with its masks, it is not solely the detection of the test stimuli but the contrast between the picture and its masks that also influences the reaction time. Moreover, the task was to distinguish living room pictures (test stimuli) from white screens (alternative test stimuli). Because the picture is shown in contrast with either a picture or a white screen, it is not solely the detection of the test stimuli but the contrast between the picture and the white screen that also influences the reaction time.

All masking stimuli were composed of parallel placed horizontal thin colored lines. Because these lines are placed parallel and are similar to each other, masking stimuli offer some way of Gestalt. Because, stimuli low in Gestalt (and to lesser extent stimuli high in information rate) shows chaotic patterns, this stimuli contrast with this mask as opposed to the other testing stimuli. Alternative test stimuli were composed of just a white screen. Stimuli high in information rate (and to a lesser extent stimuli low in Gestalt) shows a great variety of colored planes, this stimuli contrast with the mask as stimuli as opposed to the other testing stimuli. Because of the difference in contrasting effect among stimuli groups, reaction time is shorter for pictures high in information rate and low in Gestalt (as opposed to pictures low in information rate and high in Gestalt).

The purpose for participants of the identification task is to identify a living room versus a garage or kitchen. To do this, participants do not need to perceive the whole environment. They need to search for several cues, such as the presence or absence of a couch, chair, cooker, car or tools and as soon as such cue is found, searching can stop and responding can begin. Due to the relative complexity of the test stimuli as opposed to less complex testing stimuli such as words (c.f. Reber, Wurtz et al., 2004), such cues are abundance. Because of the relative equal complexity of all stimuli, cues are equal abundant in all stimuli. Therefore, the task itself will have a leveling off effect on all data. Moreover, this effect could have been strengthened by the difference in complexity between all control stimuli and all test stimuli. Therefore, there were not found any significant differences between test stimuli.

Although the data from the APP did not support any of the hypotheses, it may support the main thesis of this article. When regarding the tasks prior to the APP, it is important to note that the test stimuli were used throughout the whole experiment. Therefore, the participants get more and more familiar with the stimuli during the experiment. More precisely, participants viewed the test stimuli twice in the detection task and twice in the identification task, before starting the APP.

Possibility exist that the mere exposure effect, the phenomenon whereby the more often people are exposed to a stimulus, the more positively they evaluate that stimulus (Zajonc, 2001), have occurred. Moreover, the mere exposure effect has been identified as a source of processing fluency which can be regarded as an explanation for the positive evaluation (c.f. Alter & Oppenheimer, 2009). Because the processing structures that enable the mere exposure effect already involve some kind of cognition (Ortony et al., 2004), this level of processing fluency can be regarded as a higher order of human processing than perceptual processing is (c.f. the routine level Ortony et al., 2004). According to Ortony et al. (2004), higher levels of processing ('routine' fluency) cannot cancel the initial processing (fluency) evoked on lower level (c.f. perceptual fluency). However, these higher levels can overrule such lower levels in the same way conceptual fluency can overrule perceptual fluency in order come to an aesthetic judgment (see Paragraph 4 on aesthetic judgment). Therefore, the 'routine' fluency evoked by the mere exposure effect and thereby positive affect leveled off all differences which were initially evoked by the perceptual fluency at a lower level. Because this mere exposure effect applied to all test stimuli equally, all stimuli should be evaluated more positively and thereby, positive words preceded by all stimuli should be rated faster than negative words. This reasoning is supported by the significant main effects for word valence for both series of pictures. An alternative explanation could be that the repetition of the pictures evoked boredom. However, such boredom would level off the mere exposure effect and thereby evoke no or negative affect (c.f. Bornstein, Kale, & Cornell, 1990). This would contradict the finding of the two significant main effects. Therefore, this explanation is rejected.

Because no significant effect of the pictures on the detection task was found, it is not possible to find any meaningful correlation between the data of the detection task and the aesthetic judgment data. Therefore, the absence of any significant correlation seems logical. The finding that living rooms high in Gestalt were preferred over living rooms low in Gestalt, regardless the aesthetic judgment condition, does not necessarily contradict the assumption that people come to a different aesthetic judgment when they depend on their gut feeling or reasoning. That is, possibility exists that at both perceptual and conceptual level Gestalt principles evoke fluency and therefore are preferred over the absence of Gestalt principles. Moreover, it emphasizes that Gestalt in interior design influences aesthetic judgments positively.

Taken together, based on the results of experiment 2, it is too early to conclude that the perceptual fluency theory in interior design can be discarded.

GENERAL DISCUSSION

Although the results of this study are mixed, experiment 1 does provide a strong argument for the assumption that the information rate in interior design does influence positive affect through perceptual fluency. When regarding living rooms low (i.e. a minimalistic design) and high (i.e. a busy design) in information rate, only living rooms with a minimalistic design evoke positive affect. Moreover, minimalistic living rooms do evoke positive affect, but not negative affect. This positive affect occurs only at a very basic level; when sensory information is processed. At a conceptual level, this information is overruled when coming to an aesthetic judgment. Due to this basic level of positive affect, one can argue that positive affect vanishes quickly and has therefore no further influence on human behavior. However, Ashby, Isen, & Turken (1999) reason, based on neurological research of Floresco, Yang, Phillips, & Blaha (1998), that an initial positive affect of only 10 seconds can evoke a prolonged positive affect of half an hour. Because positive affect has been linked to a great variety of positive effects on humans (e.g. Fredrickson, 2001; Isen, 2001) it is important to test whether a perceptual fluency evoking environment (e.g. by means of minimalistic design) can evoke such prolonged positive affect.

Moreover, the perceptual fluency theory in interior design would integrate the Kaplan (1987) and Ulrich (1983) model. The most important difference between the Kaplan (1987) and Ulrich (1983) models lies in its respectively affective and cognitive nature of processing. Kaplan (1987) states that human preferences are the result of a cognitive assessment of an environment on certain informational features, which in turn lead to affect. Ulrich (1983) argues that affective responses toward environmental responses are not mediated by cognition; instead these are the result of a rapid and automatic process in which the environments are immediately liked or disliked. The perceptual fluency model does allow for both views.

When someone perceives an environment, at an initial stage some cognitive work (or pattern recognition (as in Ortony et al., 2004)) is done in order to process information of the environment (as in Kaplan (1987) and Winkielman et al (2000)). (Note that up to this point, the difference between the Kaplan (1987) and Ulrich (1983) model lies in the definition of what cognitive work is needed to process this initial perceptual information.) The accuracy and ease with which the perceptual information is processed is reflected in perceptual fluency (as in Winkielman et al (2000)). This perceptual fluency can be influenced by the information rate and Gestalt principles ‘available’ in the perceived environment (as proposed in this study). Note the resemblance of this reasoning with the immediate factors for preference of Kaplan (1987). On its turn, this fluency evokes a positive affect (or not), which is supported by the results of experiment 1 and the view of Ulrich (1983). These environmental evaluations occur at a rather quick basis, which pays tribute to the work of Korpela et al. (2002; 2004) and is illustrated by the results of experiment 1. The evoked affect can be used as guidance for the aesthetic judgment (as in the view of Ulrich (1983)). However, it can be overruled by higher order processing fluencies such as the mere exposure effect (as in the APP in experiment 2) or aesthetic cognitions (as in the aesthetic judgment tasks in experiment 1). Note the resemblance of this reasoning with the inferred or predicted factors of Kaplan (1987). Therefore, it is to say that neither the Kaplan (1987) or the Ulrich (1983) model tells the whole story, these theories missed the integrative theory of processing fluency.

The missing link in this reasoning is the empirical evidence that the relation between perceptual fluency and aesthetic judgment is mediated by perceptual fluency. Moreover, the hypothesis that the usage of Gestalt principles in interior design evokes perceptual fluency is not yet confirmed. And last, for a relation between the APP and the aesthetic judgment moderated by higher levels of processing (experiment 1), hard evidence is missing. To counter these issues, new experiments should be conducted. To avoid habituation of the stimulus (and thereby the mere exposure effect), the detection task and APP should be separated into different experiments. The identification task should be omitted for the same purpose. In an attempt to create a more realistic detection task, dark masks should be used (which are assumed to be more or less similar to the opening and closing of an eye). Note that, when not showing a mask, the programmed background color then preceding and following the picture is 'the mask' and therefore it cannot be argued that no mask is shown. Special care should be taken in order to prevent differences in contrasting mask-stimuli-picture pairs between stimuli groups. Moreover, the APP should be introduced with more target practice trials for the participants to evoke stronger positive or negative valence. Both the detection task and the APP should be followed by a between subjects design in which participants complete a gut feeling or elaborative reasoning aesthetic judgment task (as in experiment 2).

Finally, one important question remains: how and can one measure perceptual fluency? Is the reaction time on a detection task a good indicator of perceptual fluency? Perceptual fluency is the ease with which something can be perceived. According to the model of Ortony et al. (2004), people are unaware of these basic forms of human functioning. By measuring perceptual fluency by means of a scale (e.g. Ellen & Bone, 1991), an elaborative reasoning is activated which can interfere with 'real' perceptual fluency. Offering such a scale afterwards would add not much information, besides that people differ in their sensory modalities and processing, which already is known (e.g. Ortony et al., 2004). Because the mean reaction time on a detection task is more difficult to be influenced by this elaborative reasoning on the long run, it is theorized that this measure is a proper derivative of perceptual fluency (c.f. Halberstadt & Hooton, 2008; Reber et al., 1998; Reber, Wurtz et al., 2004; Winkielman, Halberstadt, Fazendeiro, & Catty, 2006). Nevertheless, it is still a derivative of perceptual fluency. Conducting the experiment by means of an EEG could overcome these problems. In such study, more precise measurements of the onset and duration of the different stages of perception are possible.

The stimuli used in this study are rather complex, as compared to stimuli used in other studies (Alter & Oppenheimer, 2009). For instance, as indicated in the discussion of experiment 2, this might have caused some kind of seeking behavior in the identification task. Moreover, participants reported that after a series of pictures, they were 'sucked up' and started somehow to focus on one point on the screen. This raises the question of what people actually see in picture tasks at high speed such as used in this thesis. Therefore the new experiments could be expanded by a using an eye tracker (or similar instruments) in order to measure what people actually perceive of a minimalistic or Gestalt environment.

Conclusively, the perceptual fluency does offer an integrative view to environmental preference models. More specific, the combined theorized models are being tested with stimuli representing nowadays environments (i.e. interior design in living rooms). Although the models of Kaplan (1987) and Ulrich (1983) seem to be integrated in this study, these models are mostly tested on natural versus urban environments. To gain more validity for the proposed model, it would be interesting to test perceptual fluency theory in such context as well.

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