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The power of liking: Highly sensitive aesthetic processing for guiding us through the world

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Abstract. Assessing liking is one of the most intriguing and influencing types of processing we experience day by day. We can decide almost instantaneously what we like and are highly consistent in our assessments, even across cultures. Still, the underlying mechanism is not well understood and often neglected by vision scientists. Several potential predictors for liking are discussed in the literature, among them very prominently typicality. Here, we analysed the impact of subtle changes of two perceptual dimensions (shape and colour saturation) of three-dimensional models of chairs on typicality and liking. To increase the validity of testing, we utilized a test-adaptation–retest design for extracting sensitivity data of both variables from a static (test only) as well as from a dynamic perspective (test–retest). We showed that typicality was only influenced by shape properties, whereas liking combined processing of shape plus saturation properties, indicating *more* complex and integrative processing. Processing the aesthetic value of objects, persons, or scenes is an essential and sophisticated mechanism, which seems to be highly sensitive to the slightest variations of perceptual input.

Keywords: aesthetic appreciation, liking, preference, design, chairs, adaptation, typicality, distinctiveness.

1 Introduction

In a visually dominated world, what we like is strongly determined by what we see. When we thoroughly analyse our trajectories through life, we constantly arrive at physical as well as psychological crossroads where we have to decide how to continue. One strong dimension on which we base our decisions is undoubtedly our assessment to which extent we like the alternatives available. And, in most cases, we lean toward the one alternative that we like the most. Preferences for one or the other alternative span a wide area of everyday situations: from which type of fish to eat, to what kind of wine to drink, to the ultimate question with whom to share the prey, the resources and even with whom to have offspring. Logically, even minor and rush decisions based on liking might have wide-reaching consequences.

Taking into account that we decide what we like not just once or on rare occasions only but with high frequency all our lives, the assessment of liking can be considered a highly overlearned processing mechanism. Furthermore, as liking obviously has a strong impact on life (decisions), life quality, and even aspects related to survival, the underlying mechanism could also be discussed from an evolutionary perspective. These considerations imply a robust, efficient, and rather universal type of processing that seems to work fast and rather implicitly. Research on liking has repeatedly uncovered results to corroborate these assumptions. For instance, Locher, Unger, Sociedade, and Wahl (1993) initially demonstrated that very brief presentations of just 100 ms are sufficient for assessing physical attractiveness (cf. Willis & Todorov, 2006). Liking evaluations of faces also seem to be quite universal (Langlois et al., 2000), indicated by a high degree of cross-cultural agreement (Perrett, May, & Yoshikawa, 1994) and are even reliable and highly consistent for people with cognitive dysfunctions such as prosopagnosia (Carbon, Gruter, Gruter, Weber, & Lueschow, 2010). In other domains, similar effects have been reported. Halberstadt and Rhodes (2003) demonstrated very high internal consistencies for attractiveness in a rating study with line drawings of birds, fish, and automobiles, a finding that was recently replicated with photographs of car exteriors (Carbon, 2010).

Typical predictors for liking that are frequently discussed are typicality, distinctiveness, novelty, familiarity, averageness, and prototypicality. Research often does not clearly differentiate between these variables and the underlying constructs. We explicitly would like to refer to sources defining and discussing such concepts, for instance differentiating distinctiveness and typicality (Wickham & Morris, 2003), distinctiveness and attractiveness (Carbon et al., 2010), typicality and novelty (Hekkert, Snelders, & van Wieringen, 2003), prototypicality and liking (Carbon, 2011), or discussing aesthetic appreciation as a construct of several variables (Faerber, Leder, Gerger, & Carbon, 2010). Some sources even assume that typicality and liking are not only closely related but that increased familiarity leads directly to increased typicality and liking (Halberstadt, 2006). Moreover, changes in typicality, for example, caused by adaptation, are sometimes assumed to produce changes in liking (Carbon, 2010).

Although linear relationships between typicality and liking (Hekkert & Snelders, 1995) as well as curvilinear relationships between typicality and liking (Blijlevens, Carbon, Mugge, & Schoormans, 2012) have been reported, we would like to remind that such findings, here originating from the domain of fundamental and applied aesthetics, respectively, do not automatically implicate causal relationships between typicality and liking. In many cases, even contradictory effects arise for both variables. For example, although iron and steel are more typical and common metals, silver and gold are preferred more (Whitfield, 2000). A closer view on such everyday phenomena reveals interesting showcases for which typicality and liking are dissociated and opens up the idea of liking being a specific, sensitive quality of perception, which cannot be easily predicted by single variables. For instance, if you take a look at the laptop market it is obvious that Apple products are highly untypical in terms of material (current year 2012 notebook models: brushed aluminium vs. plastic), shape (latest models: round corners), and colour (silver vs. commonly black or beige), yet they are highly appreciated as shown by their market success. Similar effects can be observed in the automobile sector: The Volkswagen Beetle does not only hold the world record for production figures but it is also one of the most distinct and thus untypical cars ever produced (see Carbon & Leder, 2005)—produced for decades challenging all theories of Zeitgeist-dependent "Formensprache" (Carbon, 2011). Still, the ultra-round-shaped Beetle has not lost any of its popularity (Carbon, 2010), while people in fact have changed their preferences for car shapes dramatically over this period of time, for instance, admiring the ultra-angular-sharp design elements of Lamborghini's "Countach" and Alfa Romeo's "Trentatre" in the 1970s and 1980s, respectively. As such distinctive examples are often liked in the same period in which liking for very typical, and obviously very different, exemplars is similarly high, typicality might play more the role of a moderator variable. Typicality is known to be processed by shape properties or deviations from shape aspects from the prototype (Panis, Vangeneugden, & Wagemans, 2008; Rosch, Mervis, Gray, Johnson, & Boyesbraem, 1976). Hence, the "typical car," the "typical skirt," or the "typical cell phone" is mostly not identified and categorized by, for instance, color aspects. There are some exceptions from this rule. For objects of natural categories whose shape-unrelated properties transport meaning, for example, a non-reddish strawberry indicates an unripe state or browning might be a sign of quality decay, such properties can indeed be linked to typicality aspects. Similarly, for specific artificial categories we might also find certain objects that are defined by non-shape-related aspects such as blue jeans, which have to be mandatorily blue to be perceived as a member of this class, or a CD that is usually produced with a silver coating, thus making a blue coated one relatively untypical, for example. For most other objects, we find a predominant shape on the basis of which we assess typicality, whereas other aspects are considered relatively irrelevant. Concerning liking, however, aspects of color or associated properties such as saturation or luminance can ultimately impact assessments, best seen for fashion goods for which our liking is indeed strongly dependent on non-shape variables such as "trend colours."

This paper aims to demonstrate the "power of liking" to differentially and sensitively process even subtle differences in certain aspects of objects, which are not fully captured by assessing typicality. We used three-dimensional (3D) models of chairs that were manipulated on two dimensions, namely shape and colour saturation (Figure 1). These two dimensions were varied on 7×7 fully crossed levels to obtain a balanced stimulus set. For a static perspective, we assessed typicality and liking ratings of these stimulus variations within a single measurement and for a dynamic perspective, to increase the validity of testing, we observed these variables within a test-adaptation–test design. We hypothesized

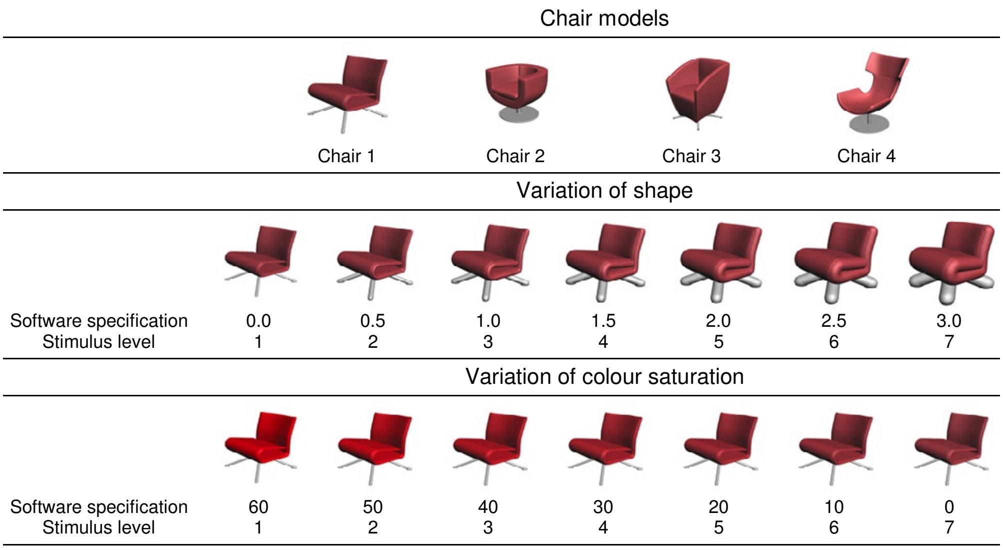

Figure 1. Three-dimensional chair models and their variation in the dimensions shape and colour saturation. Each of the four chair models was systematically varied on seven levels of shape crossed with colour saturation. The levels of shape relate to the parameter of inflation strength of the Autodesk 3ds Max software, and the levels of colour saturation are specifications of Adobe Photoshop. All levels show equidistance in physical terms.

that typicality ratings are mainly driven by changes in shape, whereas liking ratings have a quality of their own, which is highly sensitive to the smallest changes in stimulus variations, which would lead to an equally strong influence of both dimensions (shape and color saturation).

2 Method

2.1 Participants

A total of 35 undergraduate students participated for course credit. This sample consisted of 29 women and 6 men with a mean age of 21.5 years ($SD = 4.1$). All of them had normal or corrected-to-normal vision assured by the *Snellen* Eye chart test; also, none of them showed any abnormal colour processing diagnosed by a subset of the *Ishihara* colour cards.

2.2 Apparatus and stimuli

The stimulus material consisted of 52 photo-realistic images of chairs sized 640 × 480 pixels, which were presented on a 17-inch Apple eMac CRT monitor with a resolution of 1024 × 768 pixels. We generated the stimuli using four 3D models of chairs (Figure 1) from the collection Archmodels vol. 1 (2005) of *Evermotion*. We varied each chair on the dimensions *shape* and *colour saturation* using Autodesk 3ds Max 2009 and Adobe Photoshop CS2 on seven levels each (see Figure 1 for an example of the systematic variation on each dimension). The levels of shape relate to the parameter “inflation strength” of the 3ds Max software directly connected with the virtual inflation of the chairs. The levels of colour saturation are specifications of Adobe Photoshop. Both dimensions were varied within physically equidistant steps. From these stimulus sets, we obtained the test set (nine stimuli per chair model, Figure 2) and the adaptation set (four stimuli per chair model, Figure 2).

2.3 Procedure

The experiment consisted of two sessions that were conducted 3–5 days apart from each other. In session 1, we implemented the first test phase (T1) and the subsequent first adaptation phase (A1) and session 2 started with a shorter adaptation phase (A2) followed by the second test phase (T2) (Figure 3).

In the identical test phases (T1 and T2), we first assessed the variable liking (German: Gefallen) and then typicality (German: Typikalität) by collecting relative judgements similar to Buckingham et al. (2006). Thereby, we showed two stimuli of the test set (always of the same chair model) simultaneously and asked the participants which of the two chairs they liked more or found more typical, respectively (the scales were introduced in advance). After choosing one chair, they further had to indicate on a five-point Likert scale (1 = “little” [wenig]; 5 = “very much” [sehr viel]) how much they

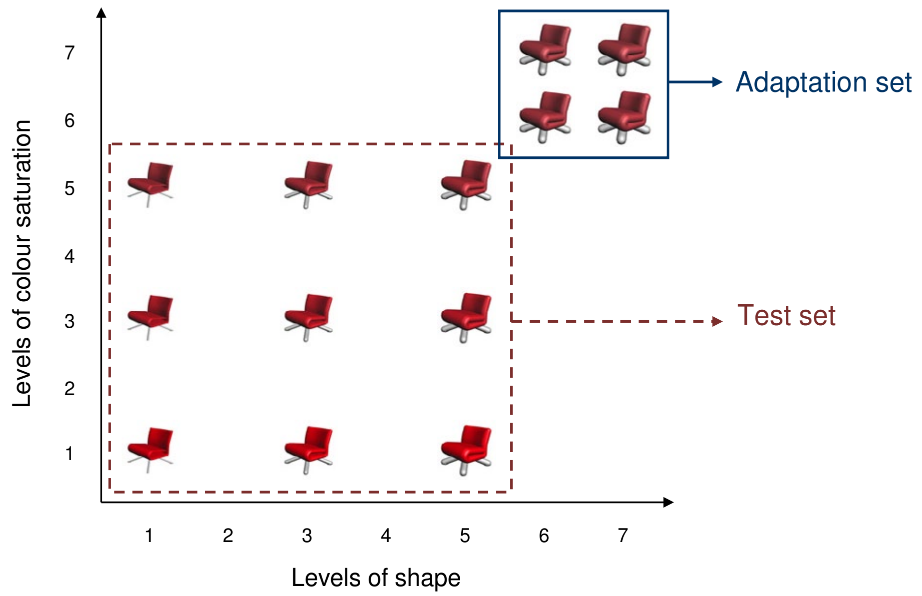

Figure 2. Test set and adaptation set. The test set consisted of a sample of the whole stimulus set with the levels 1, 3, and 5 of shape as well as colour saturation, resulting in 3 × 3 = 9 stimuli per chair model. The adaptation set included the levels 6 and 7 of either shape or colour saturation and their combinations, yielding 2 × 2 = 4 stimuli per chair model.

liked the chosen chair more (or how much they found it more typical, respectively) than the other one displayed (see Figure 3). For each variable, the participants gave 144 relative ratings consisting of 36 ratings per chair model, because for every chair model each stimulus of the 9 stimuli of the test set was compared with each of the remaining ones. We balanced the display side of the paired stimuli on the screen and randomized the order of the stimulus pairs. The task was self-paced and the experimental setting identical for both variables.

In the adaptation phases (A1 and A2) we introduced the repeated evaluation technique (Carbon & Leder, 2005; Faerber et al., 2010). With this technique, participants rate the stimulus material on

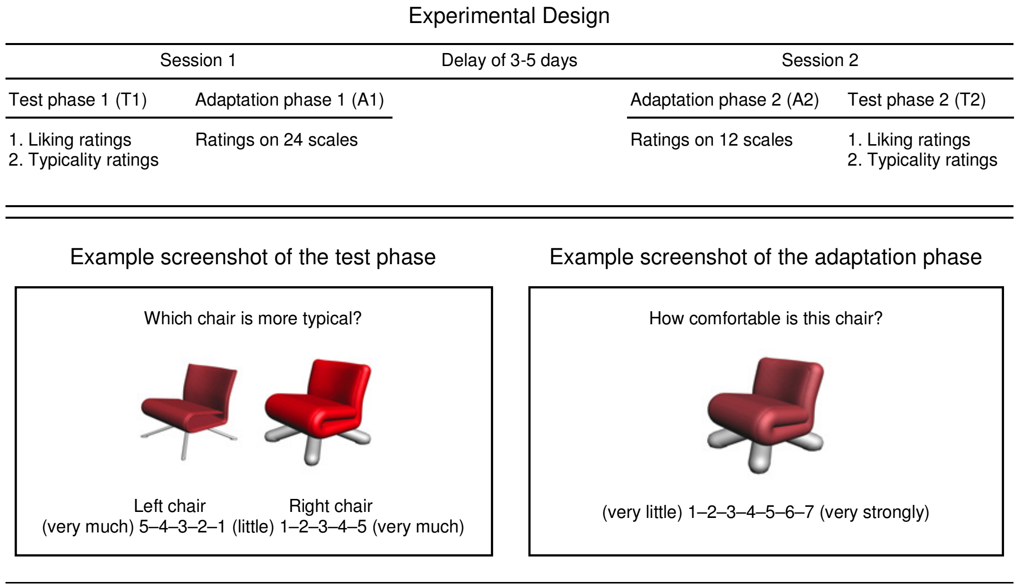

Figure 3. Experimental design. Session 1 consisted of the test phase 1 (typicality and liking ratings) and the first adaptation phase. After a delay of 3–5 days, session 2 followed comprising a second shorter adaptation phase and ending with test phase 2 (typicality and liking ratings). Examples of screenshots of the test and the adaptation phase are shown.

different scales to prompt a deep elaboration of the stimulus material in a controlled way, proved to induce dynamic effects of aesthetic appreciation for a wide range of participants, from typical volunteers such as students (Carbon, Michael, & Leder, 2008) to aged persons with no academic background (Carbon & Schoormans, 2012). In phase A1, participants rated the adaptation stimuli on the following 24 scales: appealing (ansprechend), carefully thought out (durchdacht), classic (klassisch), compact (kompakt), conventional (konventionell), durable (beständig), elegant (elegant), extravagant (extravagant), formal (förmlich), functional (funktionell), futuristic (futuristisch), inviting (einladend), neat (ordentlich), of high quality (hochwertig), embellished/playful (verspielt), overwhelming (erdrückend), pleasant (angenehm), dull (eintönig), regular (regelmäßig), restrained (dezent), rounded (abgerundet), solid (gediegen), tasteful (geschmackvoll), and stuffy (bieder). Phase A2 was half as long as A1 and comprised the following 12 scales: bulky (sperrig), clear (klar), comfortable (komfortabel), conservative (konservativ), well-considered (überlegt), practicable (praktisch), luxurious (luxuriös), minimalist (schlicht), modern (modern), robust (robust), stylish (stilvoll), and inventive (phantasievoll). In A1 and A2, first the question and one of the 16 (four per chair model) adaptation stimuli were displayed for either 1,000, 2,000, or 3,000 ms. Thereafter, the stimulus disappeared and was displayed again together with a general seven-point Likert scale (1 = "very little" [sehr wenig]; 7 = "very strongly" [sehr stark]) applied to all scales. The next stimulus was presented automatically after the participant pushed a response key. The orders of stimuli as well as the scales of both adaptation phases were fully randomized. The experiment was controlled by PsyScope 1.25 PPC (Cohen, Macwhinney, Flatt, & Provost, 1993), with all participants being tested individually.

2.4 Handling of the raw data of the collected relative ratings

As we collected data for typicality and liking through relative ratings, we recalibrated the raw values to a range of −4.5 to 4.5 to receive a scale with equidistant and continuous levels. For example, when a participant rated a stimulus with "1" as more typical, then this stimulus was assigned 0.5 points and the paired stimulus −0.5 points for this rating. For further processing of the data, we averaged the recalibrated data across the different ratings for each stimulus and also across the four different chair models.

3 Results

Our main interest in this study was the sensitivity of typicality and liking ratings for subtle changes of the stimulus material from a static as well a dynamic perspective. For the initial ratings (test phase T1), descriptive statistics and *t*-tests between levels for each dimension are presented in Figure 4.

To explore the static perspective, we observed the initial ratings (in test phase T1) of typicality and liking by conducting two two-way within-participants analyses of variance (ANOVAs) with shape (levels 1, 3, and 5) and colour saturation (levels 1, 3, and 5) as within-participants factors and with either typicality or liking ratings as dependent variable (Table 1). We observed a significant main effect for shape for both typicality and liking ratings, but only for liking the analysis showed a significant effect for colour saturation. Thus, although typicality was highly sensitive for variations in shape, only liking ratings were sensitive to both implemented dimensions.

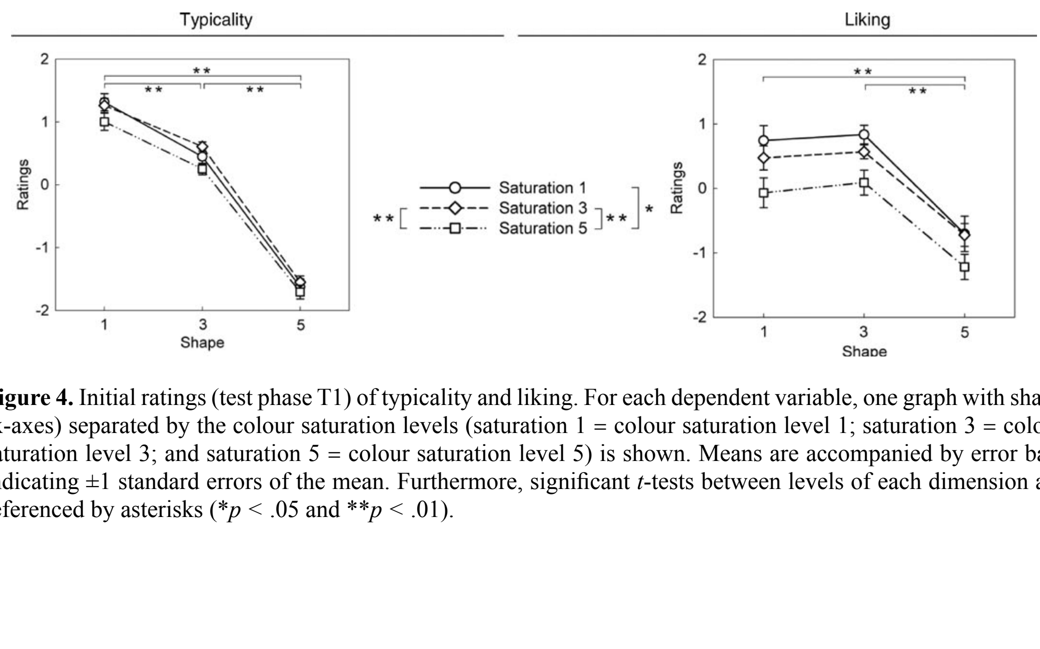

Figure 4. Initial ratings (test phase T1) of typicality and liking. For each dependent variable, one graph with shape (x-axes) separated by the colour saturation levels (saturation 1 = colour saturation level 1; saturation 3 = colour saturation level 3; and saturation 5 = colour saturation level 5) is shown. Means are accompanied by error bars indicating ±1 standard errors of the mean. Furthermore, significant *t*-tests between levels of each dimension are referenced by asterisks (**p* < .05 and ***p* < .01).

Table 1. Results from the static perspective (in test phase T1) and from the dynamic perspective (differences in rating between test phases T2 and T1). Effects of shape, saturation, and their interaction on typicality and liking ratings.

		Typicality			Liking		
Effect	*df*	*F*	*p*	ηp²	*F*	*p*	ηp²
Static view (T1)							
Shape	2/68	182.68	.001**	0.84	15.75	.001**	0.32
Saturation	2/68	2.95	.059	0.08	6.42	.003**	0.16
Shape × saturation	4/136	2.34	.059	0.06	2.10	.085	0.06
Dynamic view (differences in ratings T2–T1)							
Shape	2/68	34.22	.001**	0.50	7.94	.001**	0.19
Saturation	2/68	<1	.883	0.01	4.20	.019*	0.11
Shape × saturation	4/136	1.28	.281	0.04	<1	.803	0.01

Note: Significant effects are indicated by asterisks (**p* < .05; ***p* < .01).

To test the sensitivity within a dynamic perspective, we used the differences of the ratings per stimulus (T2 minus T1) and conducted on this basis two two-way within-participants ANOVAs with shape (levels 1, 3, and 5) and colour saturation (levels 1, 3, and 5) as within-participants factors and with either typicality or liking ratings as dependent variable (Table 1). Results showed again a significant main effect for shape for both variables; however, only liking ratings revealed a significant effect for colour saturation. These effects were confirmed through follow-up *t*-tests on a stimulus base comparing T2 versus T1 ratings per dependent variable (Figure 5). Figure 5 shows the effect sizes of the respective *t*-tests within the 2D stimulus space for liking and for typicality graphically as heat maps. For typicality, we found three stimuli increasing and three stimuli decreasing significantly in typicality. For liking, we found two stimuli increasing and two stimuli decreasing significantly in liking. For liking, the overall changes were less pronounced than for typicality but, as Figure 5 shows, these changes affect both dimensions in a comparable way.

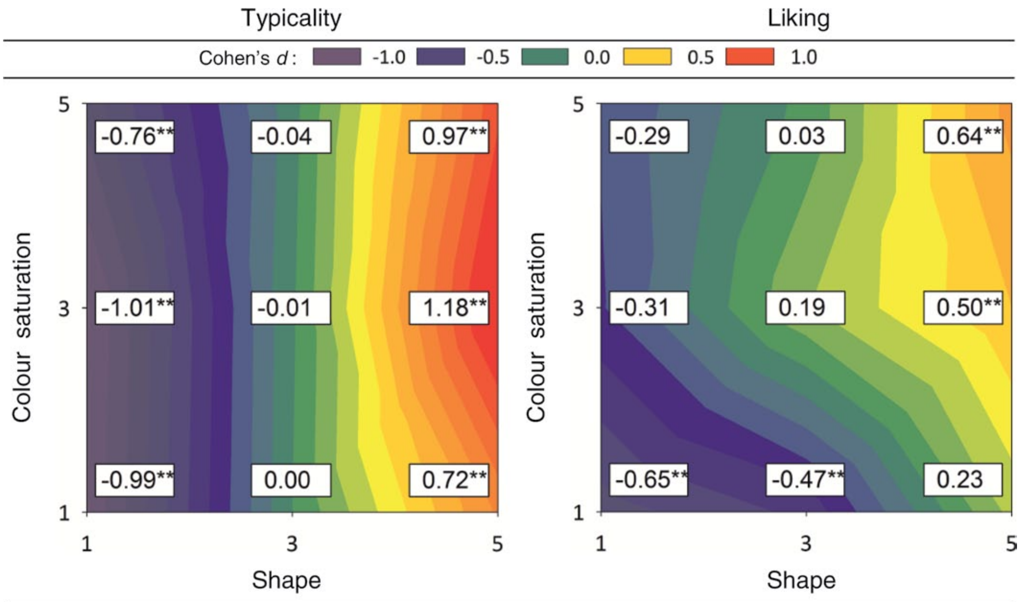

Figure 5. Dynamics of perception. Within the implemented stimulus space, which was realized by variations on the dimensions shape and colour saturation, the changes over time for the dependent variables are indicated through the effect sizes of the *t*-tests comparing ratings of T2 versus T1. Significant effects are indicated by asterisks (***p* < .01).

4 Discussion

The ability to decide what we like guides our everyday lives, from less important decisions of what jeans to buy to more significant ones as to what type of food to eat. Because every day we frequently make such preference decisions based on liking, the underlying mechanism needs to work promptly and efficiently, robustly and rather automatically. To demonstrate this "power of liking," particularly its high sensitivity, we contrasted liking ratings for 3D models of chairs, which were manipulated on two dimensions, shape, and colour saturation, with typicality ratings assumed to be tightly linked to liking (e.g., Halberstadt, 2006; Hekkert et al., 2003).

Results from a static as well as from a dynamic perspective demonstrated liking ratings to be highly sensitive to changes of shape as well as colour saturation, whereas typicality ratings were exclusively influenced by variations of shape. This supports the hypothesis that liking ratings are more sensitive to subtle changes of the stimulus material than assessments of typicality. We would also like to qualify liking as being a more integrative and potentially *more* complex process than typicality, as it was not exclusively based on shape aspects. Consequently, liking decisions comprise more than the degree of typicality, which is in line with former studies showing that variables other than typicality influence liking, among them being novelty (Hekkert et al., 2003), innovativeness (Faerber et al., 2010; Leder & Carbon, 2005), or complexity (Berlyne 1970).

The dissociated influences of shape and colour saturation on typicality and liking can be explained by different levels of attention while assessing either typicality or liking. In accordance with this idea, Busey (1998) discussed effects of selective attention on the face space, which could either expand or shrink a particular dimension. Similarly, Lin and Murphy (1997) found differences in categorization due to different background knowledge participants had gained during the learning of a category. Depending on the attention participants paid to specific parts of the exemplars, they categorized the very same exemplars differently and were not aware of missing components, if they were not ultimately important for the categorization process. The view that the relevance of a certain dimension for the specific cognitive process determines the level of attention we direct to it supports the general evolutionary idea of an adaptive cognitive apparatus using sparse but specific relevant information in a very fast way in favour of slowly processing the sum of task-irrelevant dimensions (Goldstone, 1998).

In the scope of this study, we varied the dimensions shape and colour saturation by implementing physically equal steps to ensure equidistant changes on a physical level. In doing so, we found effects of colour saturation only for liking, but results also showed a trend of colour saturation for typicality from a static perspective. Within this study, it remains unclear whether a significant effect of colour saturation could be detected, if the changes of this dimension were less subtle or equalized perceptually with the respective levels of the dimension shape. For further studies and specifically to enable a better comparison of both dimensions, the manipulation of the levels of the dimensions could be equalized on a perceptual basis instead of equalizing the levels on a physical basis as done in this paper. Importantly, the differences observed between liking and typicality cannot be explained by this limitation, because both variables were manipulated equally within the experimental design, but showed dissociate effects on both dependent variables.

We investigated typicality and liking for an artificial category. It is very likely, though, that similar dissociations between typicality and liking could be found within natural categories such as faces. Shape was repeatedly shown to moderate typicality as well as liking of faces, although it is uncertain whether different saturation levels would alter both of these ratings. Stephen, Coetzee, and Perrett (2011) showed that above-average carotenoid faces are perceived as more healthy. Consequently, because faces that are seen as healthier are perceived as more attractive, carotenoid faces must be more attractive. However, this most attractive level of carotene is not the average level and, thus, probably not the most typical one. Such dissociating effects for averageness and attractiveness of faces sometimes mentioned in the literature (e.g., DeBruine, Jones, Unger, Little, & Feinberg, 2007; Perrett et al., 1994) might be further evidence that the mechanisms for assessing typicality and liking or averageness are differently sensitive to variations of the perceived objects.

We demonstrated a dissociation of typicality and liking within an artificial category—two variables that are often interpreted as being causally related to each other. Most importantly, in contrast to typicality, liking seems to be a processing mechanism that is highly sensitive to even subtle changes of objects. These results point to the "power of liking" as an expertise processing mechanism that reflects a presumably complex and highly sensitive perceptual mode. One speculative reason for its sensitive nature is its evolutionary importance, providing the basis for a development over several million years.

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