Research Article

Prototypes Are Attractive Because They Are Easy on the Mind

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ABSTRACT—*People tend to prefer highly prototypical stimuli—a phenomenon referred to as the* beauty-in-averageness *effect. A common explanation of this effect proposes that prototypicality signals mate value. Here we present three experiments testing whether prototypicality preference results from more general mechanisms—fluent processing of prototypes and preference for fluently processed stimuli. In two experiments, participants categorized and rated the attractiveness of random-dot patterns (Experiment 1) or common geometric patterns (Experiment 2) that varied in levels of prototypicality. In both experiments, prototypicality was a predictor of both fluency (categorization speed) and attractiveness. Critically, fluency mediated the effect of prototypicality on attractiveness, although some effect of prototypicality remained when fluency was controlled. The findings were the same whether or not participants explicitly considered the pattern's categorical membership, and whether or not categorization fluency was salient when they rated attractiveness. Experiment 3, using the psychophysiological technique of facial electromyography, confirmed that viewing abstract prototypes elicits quick positive affective reactions.*

People tend to prefer highly prototypical stimuli over more unusual exemplars—a phenomenon referred to as the *beauty-in-averageness* effect. One well-known illustration of this phenomenon is preference for prototypical or average faces (Langlois & Roggman, 1990; Rhodes & Tremewan, 1996). The beauty-in-averageness effect is often theoretically explained as reflecting a biological predisposition to interpret prototypicality as a cue to mate value (Symons, 1979). For example, facial, as well as bodily, prototypicality may be predictive of current or prior health, lending individuals with a prototypicality preference a reproductive advantage (Thornhill & Gangestad, 1993). However, at least for faces, recent research suggests that the relation of prototypicality to actual, rather than perceived, health is relatively weak (Kalick, Zebrowitz, Langlois, & Johnson, 1998; Rhodes et al., 2001). Furthermore, if people prefer prototypicality because it signals reproductive fitness, this preference should not necessarily extend to fitness-irrelevant stimuli. Yet several studies have shown comparable effects in a wide variety of natural and artificial categories, including dogs, birds, fish, automobiles, and even watches (Halberstadt & Rhodes, 2000, 2003).

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PROTOTYPICALITY AND FLUENCY

These theoretical and empirical considerations motivate a search for more general cognitive mechanisms underlying preference for prototypicality. One promising candidate is suggested by findings that prototypes are processed fluently, that is, with greater speed and efficiency than other stimuli. For example, when presented with random-dot patterns, people classify prototypical patterns faster than distorted patterns (Posner & Keele, 1968), and recruit fewer neural resources to perceive prototypical patterns (P.J. Reber, Stark, & Squire, 1998).

Interestingly, research also suggests that fluent processing elicits positive reactions. Thus, manipulations that enhance fluency (e.g., priming, clarity, increased stimulus duration, multiple prior exposures) yield more favorable judgments of stimuli (Winkielman, Schwarz, Fazendeiro, & Reber, 2003). It is important to note that the increase in favorability occurs whether participants judge fluently processed stimuli on positive dimensions (e.g., liking, goodness, prettiness) or negative dimensions (e.g., disliking, badness, ugliness) and thus cannot be explained by simple judgment biases (Reber, Winkielman, & Schwarz, 1998; Seamon, McKenna, & Binder, 1998). Further, psychophysiological methods, such as facial electromyography (EMG), reveal that fluent processing is associated with more positive reactions to stimuli, as reflected in greater activity over the region of the zygomaticus major—the cheek muscle responsible for smiling (Harmon-Jones & Allen, 2001; Winkielman & Cacioppo, 2001). Some fluency manipulations, such as multiple stimulus repetitions (Monahan, Murphy, & Zajonc, 2000) and enhanced reading speed (Pronin & Wegner, 2006), might even temporarily elevate mood. Presumably, all these positive reactions occur because fluency indicates error-free processing and successful recognition of a stimulus. Fluency is also a probabilistic cue to previous experience, indicating in many contexts that the stimulus is likely to be relatively benign (for review, see Winkielman et al., 2003).

If prototypical stimuli are processed fluently, and stimuli that are processed fluently are attractive, then perhaps prototypes are attractive because of their fluent processing. If so, fluency could provide a parsimonious mechanism for the attractiveness of prototypes across a variety of biological and nonbiological categories without relying on assumptions about their reproductive value.

CURRENT RESEARCH

We conducted three experiments to assess the effects of prototypicality on preference. Experiments 1 and 2 examined the relation between preference (measured by attractiveness ratings) and fluency (measured by categorization speed). Experiment 3 used facial EMG to examine the link between prototypicality and positive affect.

Following earlier research, we manipulated prototypicality in all three experiments by mathematically distorting dot-pattern prototypes (Posner & Keele, 1968). Experiments 1 and 3 used prototypes of abstract patterns (random dots) to eliminate any resemblance to reproductively relevant categories, and to minimize issues inherent in using distortions of meaningful stimuli, such as prior experience and symmetry (Rhodes, Sumich, & Byatt, 1999). Experiment 2 used prototypes of geometric patterns (a square and a diamond) to assess whether the findings with abstract patterns generalize to meaningful material. This question is important because (a) previous demonstrations of prototype attractiveness have relied on meaningful stimuli, and (b) people may not draw on fluency, a nonanalytic source of information, when other diagnostic sources of information about the stimulus are available (Schwarz & Clore, 1996). The use of both meaningless and meaningful material provides a strong test of the role of fluency in influencing the attractiveness of prototypes.

In Experiments 1 and 2, we expected that with both random and meaningful patterns, participants would (a) prefer more prototypical patterns over less prototypical patterns and (b) process more prototypical patterns more fluently than less prototypical patterns. More important, we expected that the second effect would explain the first—that is, that fluency would account for a significant degree of participants' preference for more prototypical patterns. In Experiment 3, we expected that prototypical patterns "prepared" by prior presentation of converging exemplars would elicit more spontaneous positive reactions, as measured by activation of the zygomaticus major muscle, than the same patterns when they were "unprepared" (i.e., when no converging exemplars were presented).

EXPERIMENT 1

Experiment 1 examined the role of fluency in influencing the attractiveness of random prototypes. Participants first judged the attractiveness of dot patterns differing in their distance from prototypes of two categories. Next, participants rapidly classified the patterns into their respective categories. Using classification speed as a measure of fluency, we analyzed whether fluency mediated the prototypicality-attractiveness relationship.

In addition, Experiment 1 tested whether fluency effects on attractiveness require that participants explicitly refer to the stimulus's category. Outside the laboratory, judgments of attractiveness may or may not refer explicitly to the stimulus category (e.g., *Finches are attractive birds* vs. *Finches are attractive*). To test the importance of category reference, we included a category name in the attractiveness question (i.e., *How attractive is this pattern for [its category]?*) for half the participants, whereas for the other half of participants, we did not include a category name (i.e., *How attractive is this pattern?*). Similar effects in the two conditions would indicate that fluency underlies attractiveness regardless of whether participants explicitly consider the stimulus category.

Method

Sixty-eight students participated for course credit. Stimuli, presented on 15-in. monitors, represented four levels of distortions of two random-dot prototypes. Prototypes were generated by randomly selecting eight dots within a 30 × 30 grid (i.e., 900 cells). Distortions were generated by independently moving each dot in a prototype to one of four concentric rings of cells surrounding the original dot, using the formula shown in Table 1 (Posner, Goldsmith, & Welton, 1967). For example, any dot in a dot pattern distorted to Level 1 would have a 75% chance of remaining unchanged, a 15% chance of being displaced to one of the eight cells directly adjacent to it, a 5% chance of being displaced to the next concentric ring of 16 cells, a 3% chance of being displaced to the third concentric ring of 24 cells, and a 2% chance of being displaced to the fourth concentric ring of 32

TABLE 1
Formula for Generating Distortions in Experiments 1 and 2

Level of distortion	Probability of dot movement to a concentric ring: No movement	Level of distortion: 1	2	3	4	Average distance of dot movement (as a fraction of dot size): Experiment 1	Experiment 2
1	.75	.15	.05	.03	.02	0.47	0.53
2	.36	.48	.06	.05	.05	0.84	0.90
3	.00	.40	.32	.15	.13	2.05	1.93
4	.00	.24	.16	.30	.30	2.58	2.60

Note. A dot was equally likely to move to any cell in the surrounding ring (see the text for explanation). The current distortion levels 1, 2, 3, and 4 correspond to distortion levels 2, 4, 6, and 7.7 in the original formula from Posner, Goldsmith, and Welton (1967).

cells. A dot was equally likely to move to any cell within a ring. See Figure 1 for illustrations of sample patterns.

The experiment had three sequential phases—training, rating, and classification. In the training phase, participants saw a total of 80 stimuli, 10 exemplars from each of the four distortion levels for each of the two categories, described as "Acks" and "Blubs." The assignment of labels to categories and presentation order were both randomized. In the rating phase, participants rated the attractiveness of 120 new stimuli representing four distortion levels of each category (i.e., 15 stimuli per level per category). The 10-point rating scale was anchored at *very unattractive* and *very attractive*. For half the participants, the instructions included a reference to the stimulus category. Specifically, participants were asked, "Please rate how attractive each Ack is (for an Ack) and how attractive each Blub is (for a Blub). Click on the point on the scale that corresponds to how attractive each pattern is, relative to other members of the same category." The other half of the participants were simply asked, "Please rate how attractive each Ack is and how attractive each Blub is. Click on the point on the scale that corresponds to how attractive each pattern is." In the final, classification phase, participants categorized the 120 patterns, presented in a new random order, as "Acks" or "Blubs" by clicking on appropriately labeled keys. Participants were asked to respond as quickly as they could without making errors.

Results

Preliminary Analyses

If a participant classified a pattern incorrectly or responded to it extremely quickly (less than 170 ms) or slowly (more than 3,866 ms, 3 *SD* above the mean), the participant's data for that pattern were not analyzed. The remaining 92% of the data was collapsed across participants to create average attractiveness ratings and fluency estimates for each of the 120 patterns. Because preliminary analyses revealed no effects of the particular prototype used to generate the stimuli, subsequent analyses collapsed across this variable.

Main Analyses

The effects of distortion on fluency and attractiveness were analyzed in two separate linear contrasts using distortion level as an independent variable. As predicted, participants categorized patterns more quickly and judged them as more attractive when the patterns were closer to their respective prototypes, Fs(1, 116) = 30.29 (fluency) and 18.52 (attractiveness), p_{rep}s = .99 (Fig. 2, top panel). Zero-order correlations showed that lower distortion correlated with faster response time (r = .45) and greater attractiveness ($r = -.37$). Critically, the less time it took participants to classify a pattern, the more attractive they judged it ($r = -.48$; for all zero-order correlations, dfs = 120, p_{rep}s = .99).

Given that the conditions for mediation were met (Baron & Kenny, 1986), we tested our critical hypothesis that fluency mediates the distortion-attractiveness relationship. A test for mediation was significant, indicating that the relation between distortion and attractiveness decreased significantly when fluency was controlled (Sobel's $z = 3.45$, p_{rep} =. 99). Interestingly, some effect of distortion on attractiveness remained even when fluency was partialed out, $r(117) = -.20$, $p_{rep} = .92$.

Finally, we examined whether the relations among distortion, fluency, and attractiveness depended on whether or not the rating instructions explicitly referred to the pattern's category membership. We found no effects for the instruction condition. Thus, the relation between fluency and attractiveness did not depend on the salience of categorization (all p_{rep}s < .77).

Discussion

The findings from Experiment 1 suggest that fluency indeed contributes to the appeal of prototypicality. As in previous work, more prototypical stimuli were both more attractive and more fluently processed than less prototypical stimuli. A novel contribution of Experiment 1 is that it shows that the second effect partially accounts for the first, as demonstrated by a decrease in the prototypicality-attractiveness relationship when fluency was controlled. Interestingly, even with fluency controlled, prototypicality continued to predict attractiveness independently. The observed relations among fluency, prototypicality, and

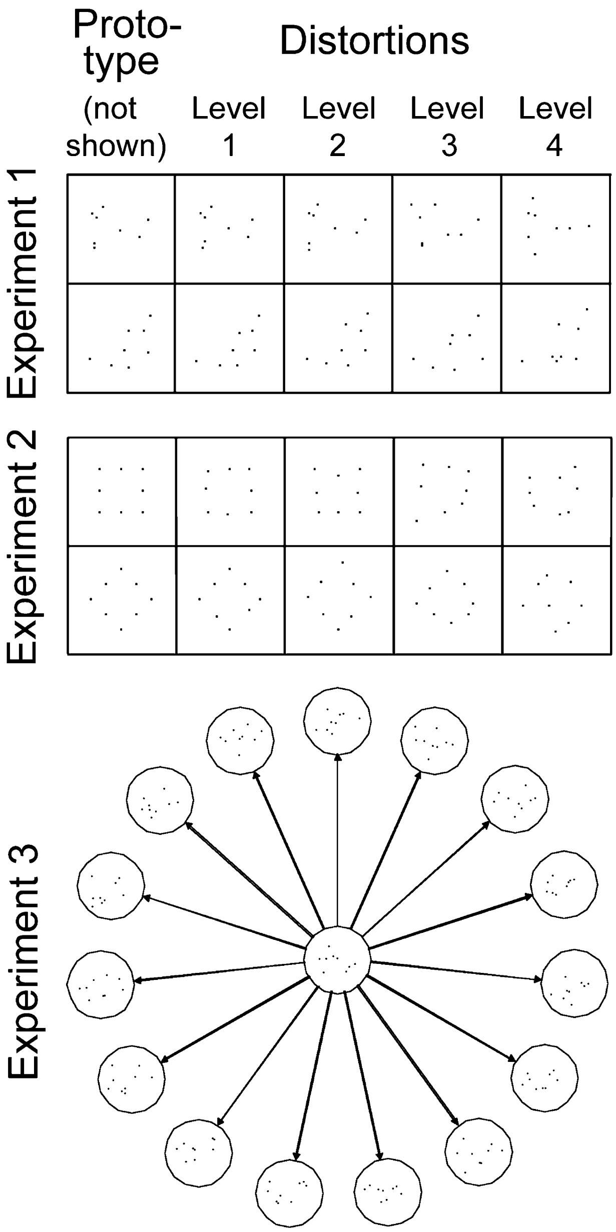

Fig. 1. Examples of stimuli used in the experiments. The top and middle panels show the original prototypes (not presented to participants) and examples of progressive distortions used in Experiment 1 and Experiment 2, respectively. The bottom panel presents an example of a category from Experiment 3; the exemplars surround the prototype, which is shown in the center.

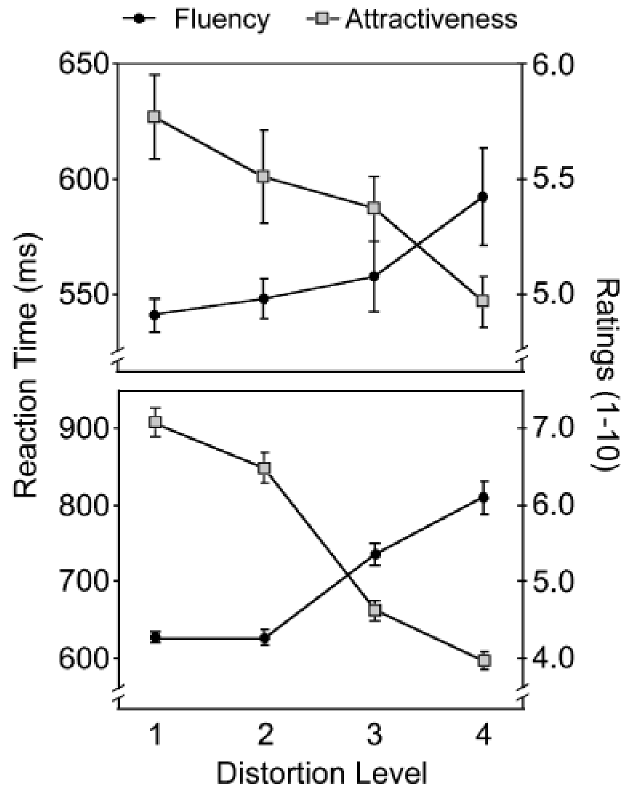

Fig. 2. Means and standard errors of fluency (reaction time) and rated attractiveness as a function of distortion level in Experiment 1 (top panel) and Experiment 2 (bottom panel).

attractiveness did not differ depending on whether or not participants were explicitly instructed to consider the patterns' category membership. Notably, these findings were obtained using patterns that were abstract and random, with no direct functional or reproductive value.

EXPERIMENT 2

Experiment 2 replicated Experiment 1 with the following modifications. First, the stimuli were derived from prototypes of two geometric shapes—a square and a diamond. This manipulation allowed us to test whether fluency underlies the attractiveness of prototypes of meaningful and nameable stimuli, for which participants could rely on other sources of information, such as assessments of functionality or previously formed preferences (Schwarz & Clore, 1996). Second, because there were no effects of instruction condition in the rating phase of Experiment 1, in the interest of clarity, we used the instructions with explicit category referents in Experiment 2. Third, we counterbalanced the order of the rating and classification tasks to further examine whether any effects depended on (a) the salience of categorization fluency or (b) the response set (i.e., the possibility that participants use the same strategy on the second task as on the first).

Method

Sixty-six students participated in exchange for travel reimbursement. The methods were similar to those of Experiment 1, with the following exceptions. Stimuli were distortions of either an eight-dot square or a diamond prototype (see Table 1 and Fig. 1). In the training phase, participants saw a total of 40 examples (5 for each of the four distortion levels) of each of the two categories, "Acks" and "Blubs" (the terms "square" and "diamond" were never used). The instructions for the attractiveness judgments always referred to the stimulus category and stated, "Please rate how attractive each Ack is (for an Ack) and how attractive each Blub is (for a Blub)." Finally, the order of the rating and classification tasks was counterbalanced.

Results

Preliminary Analyses

As in Experiment 1, we analyzed data only for those stimuli that a participant classified correctly with a response time that was more than 170 ms and less than 3 standard deviations above the mean (2,150 ms). The data from the remaining 87% of the trials were collapsed across participants to create mean attractiveness ratings and fluency estimates for each of the 120 patterns. Because preliminary analyses revealed no effect of the specific prototype used to generate the stimuli (square vs. diamond), this variable was dropped from subsequent analyses.

Main Analyses

Data were again analyzed in two linear contrasts using distortion level as the independent variable. As predicted, relative to distorted patterns, more prototypical patterns were categorized more quickly and judged to be more attractive, $F\text{s}(1, 116) = 100.75$ (fluency) and 229.58 (attractiveness), $p_{\text{rep}}\text{s} > .99$ (Fig. 2, bottom panel). Zero-order correlations showed that closeness to prototype correlated with faster categorization ($r = .66$) and greater attractiveness ($r = -.80$). Faster categorization also correlated with greater attractiveness ($r = -.78$; all $df\text{s} = 120$, $p_{\text{rep}}\text{s} = .99$). Again, fluency mediated the relation between distortion and attractiveness (Sobel's $z = 7.78$, $p_{\text{rep}} > .99$). However, as in Experiment 1, the partial effect of distortion on attractiveness remained significant when fluency was controlled, $r(117) = -.62$, $p_{\text{rep}} = .99$.

Finally, the relations among attractiveness, distortion, and fluency did not depend on whether participants performed the rating task or the classification task first (all $p_{\text{rep}}\text{s} < .79$). Further, the relation between fluency and attractiveness did not change even when the attractiveness and fluency estimates for the patterns were based only on the first task for each participant (i.e., the attractiveness scores were taken only from participants who performed the rating task first, and the fluency scores were taken only from participants who performed the classification task first). These findings confirm that the fluency-attractiveness relation is robust and does not depend on the salience of participants' classification performance.

Discussion

The findings from Experiment 2 replicated the relations among fluency, prototypicality, and attractiveness obtained in Experiment 1. Fluency again accounted for a significant proportion (but not all) of the variance in the prototypicality-attractiveness relation. Notably, these findings were obtained with meaningful and familiar patterns to which participants could apply other knowledge. Yet, if anything, the role of fluency was even more pronounced in Experiment 2 than in Experiment 1. Finally, the relations among fluency, prototypicality, and attractiveness did not depend on the salience of categorization performance.

EXPERIMENT 3

Most beauty-in-averageness research relies on self-reports—typically in the form of judgments of attractiveness or liking. However, such judgments may not always reflect genuine affective reactions to the stimuli. For example, in some contexts, participants could use the dimension of attractiveness as a proxy judgment of distance from a prototype, or as a "cold" judgment of stimulus quality. Therefore, it is important to examine whether participants show genuine positive reactions to prototypical stimuli, even when dealing with abstract, random patterns. Genuine positive reactions should be reflected in psychophysiological measures, such as facial EMG. Many studies have shown that positive affective reactions manifest themselves in incipient smiles, as reflected by increased EMG activity over the cheek region, whereas negative affective responses manifest themselves in incipient frowns, as reflected by increased EMG activity over the brow region (Cacioppo, Petty, Losch, & Kim, 1986). Facial EMG can detect mild affective reactions to subtle stimuli that do not elicit fully developed emotional expressions (Cacioppo, Bush, & Tassinary, 1992; Dimberg, Thunberg, & Elmehed, 2000).

Previous research has demonstrated that facial EMG can detect affective reactions to fluency manipulations. For example, Winkielman and Cacioppo (2001) found that enhancing fluency with identity priming and with increased stimulus duration results in mild positive responses, as reflected in increased activity over the cheek (but not brow) region. Further, these authors found that the response over the cheek region occurs rapidly upon stimulus viewing, suggesting that the positive affective reaction is spontaneous.

To test affective reactions to prototypes, we slightly modified the paradigm used in Experiments 1 and 2. Specifically, we first exposed participants to several distortions of abstract random-dot patterns converging on a prototype. Then, we assessed participants' affective reactions upon viewing a novel, but "prepared" pattern (i.e., the prototype) versus a control, "unprepared" pattern (the prototype of another, unseen category). We based this paradigm on classic studies demonstrating that participants process a novel, but prepared prototype more fluently (i.e., categorize it more quickly) than an unprepared pattern (Posner & Keele, 1968). In addition, this paradigm was recently used in studies demonstrating higher attractiveness judgments for novel prepared face prototypes (Rhodes, Halberstadt, & Brajkovich, 2001; Rhodes, Halberstadt, Jeffery, & Palermo, 2005). We predicted that compared with the unprepared prototype, the prepared prototype would elicit greater immediate EMG activity over the cheek (but not brow) region.

Because this design used presentation of different converging distortion patterns to manipulate prototype fluency, it coincidentally also allowed a test of how a single prior exposure to a pattern influences affective responses. To take advantage of this opportunity, we also compared EMG reactions to previously seen distortion patterns relative to novel control patterns. We expected only a weak effect given that we used only a single presentation, whereas exposure effects on affective responses typically require multiple repetitions of the same pattern (i.e., the mere-exposure effect; Harmon-Jones & Allen, 2001; Seamon et al., 1998; Zajonc, 1968).

Method

Twenty-one students participated individually for extra credit. Stimuli were nine-dot patterns presented centrally on a 17-in. monitor. Using software by Goldstone (2000), we created 20 random prototypes within a 300-pixel × 300-pixel matrix; each prototype had 15 distortions (see Fig. 1). Distortions were generated by randomly moving each 18-pixel dot by 30 pixels, or by 1.66 times the dot size (the degree of distortion was approximately between Levels 2 and 3 in Experiments 1 and 2).

The experimental procedure consisted of 10 alternating viewing and testing phases. In each viewing phase, participants simply viewed 15 distortions, but not the prototype, from one of the 10 categories. Each stimulus appeared for 1 s and was separated from the next by a 400-ms blank. Each viewing phase was followed by a testing phase, in which participants saw four patterns in a random order (i.e., in total, participants saw 40 test patterns). Two patterns were prototypes: the prototype of the category viewed and the prototype of a category not viewed (i.e., control prototype; order of category presentation was counterbalanced across participants). The two other patterns were distortions: a distortion previously viewed and a control distortion from a category not viewed (order counterbalanced). In the testing phase, each trial (i.e., presentation of a test pattern) started with a 4-s fixation cross, followed by a 2-s pattern and then a 4-s fixation star. At the end of each trial, participants rated the pattern just shown on a 9-point liking scale.

EMG Recording

The EMG recording and processing conformed to psychophysiological standards (Fridlund & Cacioppo, 1986) and followed the methods of earlier studies on affect and fluency (see Winkielman & Cacioppo, 2001, for more details). Two adjacent Ag/AgCl electrodes, with impedances reduced to less than 10 kΩ, were placed over each region to be tested: the left zygomaticus major (cheek) muscle and the corrugator supercilii (brow) muscle. We also recorded from two other regions, orbicularis oculi (eye corner) and medial frontalis (forehead), to control for blinking and nonspecific facial responses. Because no main effects or interactions were observed for these latter two regions, they are not discussed further. EMG signals were acquired with Neuroscan equipment, filtered with a 10-Hz to 500-Hz band pass, and sampled at 2048 Hz.

EMG Data Reduction

Raw EMG signals were submitted to standard data-processing steps (Fridlund & Cacioppo, 1986). First, the signals were integrated, rectified, and screened for movement artifacts. Second, the data were logarithmically transformed (to reduce the impact of extreme values) and standardized within participants and within individual muscle sites (to reduce individual variability and allow meaningful comparison between muscle sites). Finally, we calculated the mean level of EMG activity during the first 3 s after each stimulus presentation and baseline-corrected those scores by subtracting the value for the corresponding 3-s prestimulus period (Winkielman & Cacioppo, 2001).

Results

To assess how prototype preparation influenced smiling and frowning, we conducted a 2 (prototype preparation: prepared vs. unprepared) × 2 (muscle region: cheek vs. brow) within-subjects multivariate analysis of variance. This analysis revealed a significant interaction, $F(20) = 4.52$, $p_{rep} = .92$, $\eta_p^2 = .18$ (Fig. 3, top left panel). Simple tests revealed that cheek activity was greater in response to prepared than in response to unprepared prototypes, $F(20) = 4.72$, $p_{rep} = .92$, $\eta_p^2 = .19$. There was no difference in brow response to prepared versus unprepared prototypes. In addition, the difference between cheek activity in response to prepared prototypes and cheek activity in response to unprepared prototypes was significant during the very first second of stimulus viewing (difference of 0.68 units), $F(20) = 4.11$, $p_{rep} = .91$, $\eta_p^2 = .17$. Again, brow response did not show this effect. Finally, we analyzed how the preparedness manipulation influenced participants' liking judgments, which were made at the end of the trial, 7 s after the stimulus presentation. Participants liked the prepared prototype more than the unprepared prototype, $F(20) = 4.13$, $p_{rep} = .91$, $\eta_p^2 = .17$ (Fig. 3, top right panel). In short, the prepared prototype elicited selective and immediate "smiling" and more favorable judgments than the unprepared prototype, a result consistent with our hypothesis that prototypicality elicits a genuine positive affective response.

Viewing a previously exposed exemplar did not generate the physiological or judgment responses that viewing a novel but prepared prototype did. A 2 (previous exposure: exposed vs. novel) × 2 (muscle region: cheek vs. brow) within-subjects multivariate analysis of variance revealed no interactions or main effects on EMG activity during the first 3 s after stimulus presentation. There were no reliable simple effects for the cheek, or brow, muscle (Fig. 3, bottom left panel). The only effect of interest was marginally greater cheek activity in the 1st poststimulus second in response to exposed versus novel exemplars (difference of 0.43 units), $F(20) = 3.15$, $p_{rep} = .88$,

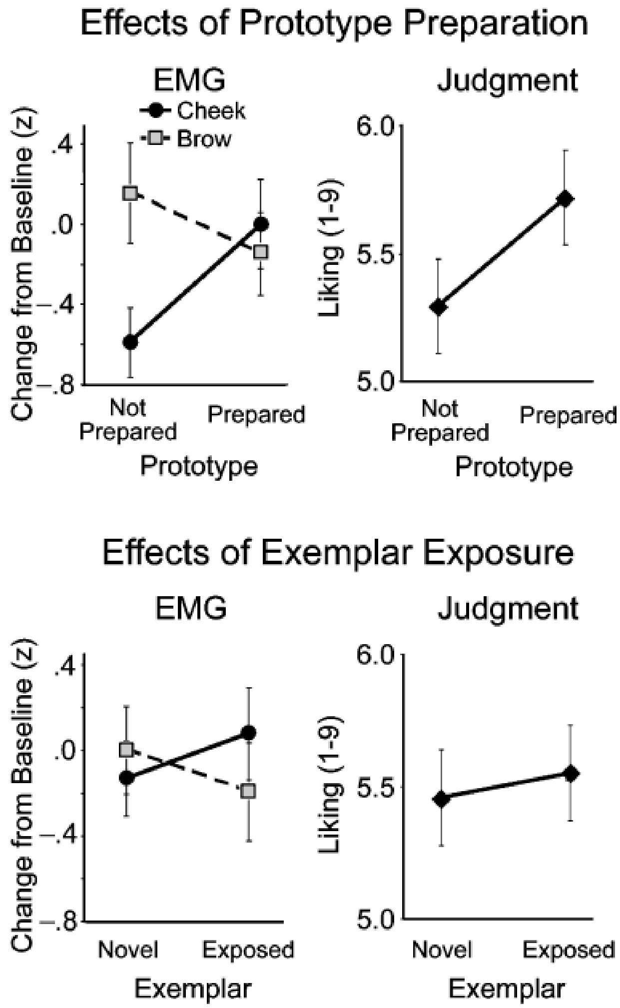

Fig. 3. Means and standard errors of electromyographic (EMG) activity and liking judgments as a function of prototype preparation (top panel) and exposure manipulation (bottom panel).

$\eta_p^2 = .14$. However, even this effect was absent in the 3rd poststimulus second. Likewise, there were no differences in liking judgments between the exposed and novel stimuli ($p_{rep} = .67$; Fig. 3, bottom right panel). In short, a single presentation of a dot pattern failed to elicit a reliable affective response as measured by physiology and self-reports, a result consistent with earlier findings that robust exposure effects require multiple repetitions (Harmon-Jones & Allen, 2001; Seamon et al., 1998; see also Rhodes et al., 2005, for discussion of the relation between the mere-exposure and beauty-in-averageness effects).

GENERAL DISCUSSION

The three experiments presented here suggest that fluency contributes to the preference for prototypical stimuli. This preference was observed for both meaningless and meaningful stimuli, and for judgments as well as psychophysiological indicators of affect. Further, the effect of fluency did not depend on whether the questions asking for attractiveness judgments explicitly referred to the stimulus category (Experiment 1), or on whether fluency was made salient by the previous task (Experiment 2). These findings suggest that fluency is used by default in attractiveness judgments.

Interestingly, Experiments 1 and 2 revealed that although categorization fluency was a significant mediator, it did not explain the entire prototypicality-attractiveness relation. Several factors might account for the remaining variance. First, for meaningless patterns (Experiment 1), attractiveness may also reflect fluency of earlier perceptual processing stages not captured by the categorization task (P.J. Reber et al., 1998; R. Reber, Wurtz, & Zimmermann, 2004). Second, for meaningful patterns (Experiment 2), attractiveness may also be influenced by symmetry, as well as higher-order considerations, such as functionality. For example, a distorted square might be judged unattractive because it is a "poor" square (i.e., lacks four equal sides). Finally, there may simply be some biological value attributable to prototypicality per se. If so, however, the current results make it unlikely that this value derives from a narrow mechanism of mate selection.

Experiment 3 demonstrated that presentation of a prototype whose processing was made fluent by prior presentation of converging exemplars enhances activity over the cheek region—a psychophysiological response indicative of positive affect. Notably, this response was immediate and sustained, suggesting that the affective reaction was spontaneous and robust. Along with converging evidence from self-reports, the physiological data indicate that participants have a genuine, if mild, preference for prototypes, even when stimuli are abstract random-dot patterns.

In sum, our findings suggest that part of the preference for prototypicality arises from a general mechanism linking fluency and positive affect. This mechanism has been shown to contribute to several preference phenomena in psychology (Winkielman et al., 2003) and aesthetics (R. Reber, Schwarz, & Winkielman, 2004). From our perspective, prototypicality is simply one fluency-enhancing variable; others include repeated exposure, perceptual and conceptual priming, contrast, clarity, increased duration, and symmetry. This explanation of prototypicality preference does not rely on considerations of value for mate selection (Halberstadt & Rhodes, 2000, 2003). Therefore, we potentially provide a parsimonious account of prototypicality preference across a wide variety of biological and nonbiological objects.

Acknowledgments—We thank Troy Chenier, Kumari Fernando, Rob Goldstone, David Huber, Kang Lee, Yuko Munakata, Andrzej Nowak, Rolf Reber, Jeanne Shinskey, Norbert Schwarz, and Bruce Whittlesea for discussions and technical advice. This research was supported by National Science Foundation Grant BCS-0217294 (P.W.) and by an Otago Research Grant (J.H.).

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(RECEIVED 2/14/05; REVISION ACCEPTED 9/19/05;
FINAL MATERIALS RECEIVED 11/8/05)