Journal of Personality and Social Psychology
2003, Vol. 85, No. 6, 1035–1048


0022-3514/03/$12.00 DOI: 10.1037/0022-3514.85.6.1035

# The Warm Glow Heuristic: When Liking Leads to Familiarity

Benoît Monin
Stanford University

Five studies demonstrate that the positive valence of a stimulus increases its perceived familiarity, even in the absence of prior exposure. For example, beautiful faces feel familiar. Two explanations for this effect stand out: (a) Stimulus prototypicality leads both to positivity and familiarity, and (b) positive affect is used to infer familiarity in a heuristic fashion. Studies 1 and 2 show that attractive faces feel more familiar than average ones and that prototypicality accounts for only part of this effect. In Study 3, the rated attractiveness of average faces was manipulated by contrast, and their perceived familiarity changed accordingly, although their inherent prototypicality remained the same. In Study 4, positive words felt more familiar to participants than neutral and negative words. Study 5 shows that the effect is strongest when recognition is difficult. The author concludes that both prototypicality and a warm glow heuristic are responsible for the "good-is-familiar" phenomenon.

Recognition is an essential but challenging component of daily social life. By connecting the present to the past, recognition maintains people's sense of self and enables them to follow their goals by placing their immediate experience in the context of a continuing narrative with recurrent people and places. Yet given how many stimuli people encounter on a given day, recognition is not always immediate, forcing them to rely on a number of meta-cognitive shortcuts to make inferences about prior exposure. For example, when a stimulus feels easy to process and there is no easy explanation why, people may interpret this fluency as familiarity (Jacoby & Kelley, 1987; Whittlesea & Williams, 2000, 2001). This article proposes that people also use another source to infer familiarity, to wit, their liking for the stimulus. I propose that people often use their affective reaction to a stimulus as a cue that they have seen that stimulus before. Because stimuli that people have encountered before tend to be liked more (Zajonc, 1968), this rule of thumb will often lead to accurate recognitions. However, the positive features of the stimulus itself (e.g., an attractive face, a positively valenced word) might make the stimulus feel familiar, even in the absence of actual prior exposure, resulting in a "good-is-familiar" phenomenon. In short, the old pickup line "Haven't we met before?" may sometimes be the good-faith result of a cognitive heuristic gone awry rather than the calculated ruse of a lounge Casanova.

This article is based in part on a doctoral dissertation written at Princeton University under Dale Miller's supervision. I acknowledge the following people (in alphabetical order) for their help or comments at various stages of the project: Zach Estes, Melissa Ferguson, Susan Fiske, Teresa Garcia-Marques, Marcia Johnson, Susan Johnson, Danny Kahneman, Ron Kinchla, Katherine Kixmiller, Karen Mitchell, Leif Nelson, Mike Norton, Danny Oppenheimer, Anne Treisman, Joseph Vandello, Bob Zajonc, and René Ziegler. I also thank Debbie Prentice and Dan Wegner for advice they provided outside of the journal review process. This research was supported by the Princeton Woodrow Wilson Society of Scholars and the University of British Columbia Peter Wall Institute for Advanced Studies.

Correspondence concerning this article should be addressed to Benoît Monin, Department of Psychology, Jordan Hall, Stanford University, Stanford, California 94305. E-mail: monin@stanford.edu

A number of investigators have raised the possibility that liking a stimulus could lead to false recognition, but efforts to provide empirical support for this hypothesis have met with mixed success. For example, Gerard, Green, Hoyt, and Conolley (1973) showed that people overestimated the number of times they had been exposed to faces rated as likable, relative to average faces—but they also overestimated how often they had seen unlikable faces. Moreland and Zajonc (1982, Study 2) found that telling participants that targets were similar to them in their values and attitudes rendered these targets more familiar to participants, but they did not find a difference in estimates of prior exposure. Langlois, Roggman, and Musselman (1994) observed that merging faces made the composite face both more attractive and more familiar and that familiarity ratings of individual faces by one panel of judges correlated highly with attractiveness ratings by another panel. Finally, Baudoin, Gilibert, Sansone, and Tiberghien (2000) reported that smiling faces lead to more false alarms (Study 1) and to higher familiarity rankings for both famous and nonfamous faces (Study 2). Following these encouraging earlier findings, this article seeks to provide an unambiguous demonstration of the phenomenon and to outline the processes underlying the effect.

## Possible Explanations for the Good-Is-Familiar Phenomenon

Two types of explanations can readily be put forward for the good-is-familiar phenomenon. One relies on the prototypicality of pleasant stimuli, whereas the other focuses on the positive reaction elicited by pleasant stimuli.

### *Prototypicality Explanations*

A first class of interpretations posits that the reason attractive faces feel familiar is because they are prototypical, and prototypes feel familiar. Let us consider the two parts of this model in turn.

*Attractive faces are prototypical.* Langlois and Roggman (1990) demonstrated that the more faces they blended together with computer software, the more attractive the resulting aggregate became (but see Alley & Cunningham, 1991; Perrett, May, &

Yoshikawa, 1994; Rhodes & Tremewan, 1996). Langlois et al. (1994) also showed that these aggregate faces were rated as more familiar and that familiarity ratings on individual faces correlated highly with ratings of attractiveness. Langlois et al. argued that the average faces are more attractive because they are more prototypical. In fact, Halberstadt and Rhodes (2000) found that prototypicality increased liking (and familiarity) even for nonsocial stimuli such as birds, dogs, or watches. And why should people like prototypes? Meyer (1956) proposed that relating stimuli to a learned structure is pleasing. Mandler (1982, 1984) posited that people like and find beautiful things that are familiar, or things that fit an existing scheme. Prototypical stimuli may thus be pleasant because they are easy to match with an existing mental image, and if they resemble an existing mental image, it is not surprising that they would elicit a sense of déjà vu.

*Prototypes feel familiar.* Indeed, not only are prototypes of a category liked better, but they also tend to feel more familiar than deviant examples of that category. In fact, after exposures to exemplars of a category, one can believe one has seen the prototype of the category even in the absence of any real exposure to it. One explanation for this finding is that exposure to exemplars from a category leads to the spontaneous generation of a prototype for that category (Rosch, 1978), and the formation of that prototype can be mistaken for exposure to the prototype in terms of recognition (Bomba & Siqueland, 1983; Franks & Bransford, 1971; Solso & McCarthy, 1981; Solso & Raynis, 1979; Strauss, 1979) or liking (Gordon & Holyoak, 1983; Rhodes, Halberstadt, & Brajkovich, 2001).

*Perceptual fluency.* The common denominator that makes prototypical stimuli both attractive and familiar may be their subjective ease of processing. As I mention above, Jacoby and his colleagues (Jacoby & Kelley, 1987; Jacoby, Kelley, Brown, & Jasechko, 1989; Jacoby, Kelley, & Dywan, 1989; Jacoby & Whitehouse, 1989) have demonstrated that perceptual fluency is an important factor in familiarity judgments. Previously encountered stimuli are easier to apprehend because a representation of them has been formed. As a result, ease of processing when encountering a stimulus is interpreted as an indication of previous exposure, or familiarity, in the absence of any basis for analytical judgment, a shortcut dubbed the *fluency heuristic* (Jacoby & Dallas, 1981; Johnston, Dark, & Jacoby, 1985). Note that from the beginning (Jacoby & Dallas, 1981), the emphasis was on relative rather than absolute fluency, and in particular on the importance of unexpected fluency, a point later elaborated by Whittlesea and Williams (2000, 2001). Furthermore, studies have shown that perceptual fluency is also used as a cue to infer that a statement is true (Reber & Schwarz, 1999), an argument flows well, or a problem is easy to solve (Jacoby & Kelley, 1987). More central to this project, Reber, Winkielman, and Schwarz (1998) demonstrated that manipulating the perceptual fluency of a stimulus influenced how much that item was liked. By preceding stimuli with a matching prime, increasing the figure–ground contrast, or increasing exposure time, they found that they could increase both experienced perceptual fluency and liking. These data suggest that perceptual fluency may constitute one of the precursors of attractiveness and thus serve as the common denominator in the attractiveness–familiarity link. In line with this thinking, Bornstein and D'Agostino (1994) have argued that the mere exposure effect was essentially a case of misattribution of perceptual fluency (see also Bornstein, 1989; Bornstein & D'Agostino, 1992), an interpretation that has been rejected by Zajonc and his colleagues (Monahan, Murphy, & Zajonc, 2000; Zajonc, 2001). It seems important to include stimuli in this research that have a valence that is independent of how easy they are to process (e.g., positive words) to test whether fluency is the necessary currency. I return to this issue in the General Discussion.

A consistent picture emerges: Attractive faces are more typical, and because they are closer to a prototype and possess fewer distinguishing features they are easier to process, making them feel more familiar. I now turn to the affect-based model.

### *Affect-Based Explanations*

An alternative class of explanations leaves prototypicality out of the picture and argues instead that the false recognition of attractive stimuli is attributable to the positive affective reaction that they elicit. For example, Garcia-Marques and Mackie (2000, 2001) have proposed that familiarity is inherently a positive feeling and that as a result, positive mood can sometimes be erroneously attributed to familiarity. They suggested that the recurrent finding that positive mood leads to shallower processing of persuasive arguments (e.g., Bless, Bohner, Schwarz, & Strack, 1990) can be traced to the fact that when in a good mood, people think they have encountered the arguments before and feel less of a need to scrutinize them. Note that the prototypicality of the arguments is an irrelevant dimension in this model, whereas affect is central.

In fact, mounting evidence points to the primary role played by affect in everyday cognition, as highlighted by Zajonc (1980) over 20 years ago. Because affective reactions require minimal stimulus elaboration and can occur very quickly, before any other type of judgment (Zajonc, 1998), they may be used even in nonaffective judgments, such as face recognition, as an auxiliary source of information if fine discrimination is required (Zajonc, 1980). The prediction that affect plays a role in higher order cognitive tasks follows from the affective primacy hypothesis. When it is not clear what dimension to use for a judgment (e.g., how positive is this ideogram?) or what information to base it on (such as a recognition task without any direct experience of subjective familiarity), individuals are likely to rely on the only thing at their disposal, their affective reaction.

Schwarz and his colleagues developed the idea that affect often serves as the basis of cognitive judgments in their feelings-as-information model and with the "How do I feel about it?" heuristic (Schwarz, 1990; Schwarz & Clore, 1988, 1996). They argued that affective states play an informative role in controlled inference processes, even in nonevaluative judgment tasks, if these are sufficiently complex and demanding. One's affective reaction to stimuli provides a convenient metric that is readily accessible when other types of information are unavailable or systematic processing is too costly. Schwarz (1990) originally focused his analysis on global mood states, because their diffuse nature makes them likely candidates for misattribution, but he has recently proposed that the same underlying logic should apply to other phenomenological experiences (Schwarz & Clore, 1996). It is possible that the positive feeling elicited by a stimulus is attributed to the right stimulus but to the wrong feature of the stimulus, to wit, familiarity. The conditions listed by Schwarz for reliance on one's affective state, other than that the judgment at hand be

affective in nature, echo the conditions normally put forth as leading to heuristic rather than analytical processing (Chaiken & Trope, 1999; Stanovich & West, 2000): Little information is available, the judgment is overly complex, and time constraints and competing task demands limit the capacity that may be devoted to forming a judgment.

I argue with Zajonc and others that people's first reaction to stimuli is affective and that later judgments are often influenced by immediate affective reaction (Schwarz, 1990; Slovic, Finucane, Peters, & MacGregor, 2002). In fact, I argue that affective–evaluative reactions ("Do I like *X*?") are used to make judgments that are on the surface unconnected to affect (e.g., "Have I seen *X* before?"). In effect, people answer a hard question by addressing an easier one instead, a process referred to as *attribute substitution* by Kahneman and Frederick (2002) and assumed to underlie most of the heuristics that have been studied in the literature (e.g., Tversky & Kahneman, 1974).

## The Warm Glow Heuristic

I propose to call the heuristic by which liking is taken as an indicator of prior exposure the *warm glow heuristic*, in reference to Titchener's (1910) introspective account of the phenomenology of recognition:

> Recognition, as such, seems to be wholly a matter of the feeling. What, then, is this feeling? In experiments upon recognition it is variously reported as a *glow of warmth*, a sense of ownership, a feeling of intimacy, a sense of being at home, a feeling of ease, a comfortable feeling. It is a feeling in the narrower sense, *pleasurable in its affective quality, diffusively organic in its sensory character* [italics added]. (p. 408)

If Titchener's account is accurate, and recognition is routinely experienced as a diffuse positive affective feeling, it raises the possibility that a positive reaction to a stimulus may be taken as an indicator of possible prior exposure.

It may at first glance seem that this phenomenon is the mirror image of mere exposure (Zajonc, 1968): Instead of the familiar being liked, the liked becomes familiar. Although it is true that there are connections between the two phenomena—in particular the fact raised earlier that the warm glow heuristic may be the result of prior experience with mere exposure—one must keep in mind a crucial difference: Whereas explicit recognition or subjective familiarity are not necessary for, and in fact seem to be impediments to, the mere exposure effect (see Bornstein, 1989), they are the output of the warm glow heuristic. Moreland and Zajonc (1977, 1979) showed that exposure impacted subjective familiarity and liking independently, whereas Kunst-Winston and Zajonc's results (1980) suggested that people are better at discriminating between new stimuli and ones previously presented subliminally if they indicate which one they prefer than if they try to say which is old, which they did not do any better than chance.[1]

## Studies

The goal of this project is twofold. On the one hand, I demonstrate that there is such a thing as a robust good-is-familiar phenomenon. On the other hand, I propose two likely explanations for the phenomenon, the prototypicality interpretation and the affect-based interpretation. The thrust of the studies presented in this article is to show the insufficiency of the prototypicality interpretation. In particular, if attractive faces were familiar only by virtue of being prototypical, the following predictions should hold:

1. The relationship between attractiveness and familiarity should disappear once prototypicality is partialed out (see Halberstadt & Rhodes, 2000).

2. Increased numbers of false alarms at high level of attractiveness should be due to lower discriminability ($d'$; see Light, Hollander, & Kayra-Stuart, 1981).

3. If perceived attractiveness is manipulated while the inherent prototypicality of the stimulus is kept constant, one should not observe a change in subjective familiarity.

4. Stimuli that are pleasant only because of their semantic valence (e.g., positive words) should not feel more familiar.

The first four studies presented in this article test each of these four predictions in turn to determine whether a prototypicality explanation is sufficient for the good-is-familiar phenomenon. My goal is to show that empirical evidence does not support the four predictions above but instead supports the opposite predictions, which are more in line with the warm glow heuristic. Study 1 replicated the correlation between attractiveness and familiarity in pictures of college students (Langlois et al., 1994) and tests the impact of partialing out prototypicality. Study 2 extended the familiarity findings to actual recognition and addresses the discriminability question. In Study 3, I manipulated the attractiveness of moderately attractive faces by contrasting them with extreme cases to test whether that was enough to influence subjective familiarity. Study 4 investigated the phenomenon in the lexical domain and in a more controlled computer-administered setup. Using a bogus subliminal exposure paradigm, I tested whether the positive valence of words could increase subjective familiarity. Study 5 explored the boundaries of the phenomenon by manipulating the difficulty of the memory task.

### Study 1: Familiarity Ratings

Langlois et al. (1994) found a strong correlation between ratings of attractiveness and familiarity of faces ($r$s = .73 for male faces and .77 for female faces, both $p$s $< .001$). Study 1 sought to replicate this finding and extend it in a variety of ways by making familiarity more concrete, partialing out prototypi-

[1] It may seem surprising, given the warm glow heuristic, that people who show clear preference for one stimulus do not use that positive affect to raise their recognition rates above chance. It turns out that they do, if you explicitly tap into the feeling of familiarity in recognition tasks. Bonnano and Stillings (1986) replicated the Kunst-Wilson and Zajonc (1980) procedure but added a recognition condition with the following instructions: "You probably won't recognize either shape, but try to choose the shape that initially seems most familiar, or pops out at you" (pp. 406–407). Bonnano and Stillings observed increased liking but no recognition when they used the same instructions as Kunst-Wilson and Zajonc. However, previously seen stimuli were recognized as much as they were preferred when participants used their feeling of familiarity.

cality (Halberstadt & Rhodes, 2000), and ruling out several alternative interpretations. The ultimate goal of Study 1 was to show that the prototypicality model is not sufficient to explain the strong correlation observed between attractiveness and familiarity.

## Method

One hundred ninety-two students who had entered Princeton University at the earliest in 1996 received money or course credit for rating 80 pictures (half of each gender), taken at random from 1995 and 1996 Princeton yearbooks, on one of the following dimensions.

*Attractiveness.* Thirty-four participants rated the attractiveness of the pictures on a scale ranging from 0 (*least attractive*) to 10 (*most attractive*). They were told to keep in mind that these were relative judgments and that across all the pictures, they should be able to use the entire range of the scale.

*Familiarity.* Forty participants were led to believe that half of the pictures represented individuals who were still on campus, though specifically not from their own class, allegedly to avoid direct acquaintance. Their task was to indicate how familiar each individual seemed by rating him or her on a scale ranging from 1 (*least confident I have seen this person before*) to 10 (*most confident that I have seen this person before*). They were also reminded that they should use the whole scale.

*Unfamiliarity.* Eighteen participants received instructions similar to those of the familiarity condition above, except that they were asked to rate how unfamiliar the faces were, on a scale ranging from 1 (*least confident I have never seen this person before*) to 10 (*most confident that I have never seen this person before*). This was meant to test whether attractiveness would correlate with any dimension thrown at participants, just as Mandler, Nakamura, and Van Zandt (1987) found that mere exposure not only increased ratings of liking but also of brightness, just as much as of its opposite, darkness, and Downs and Shafir (1999) found that "enriched" stimuli are more likely both to be selected or rejected, depending on the framing of the question.

*Smiles.* To verify that any correlation could not essentially be boiled down to differences in facial expression (Baudoin et al., 2000), 8 participants rated how much people in the pictures smiled, on the following scale: 0 (*no smile*), 1 (*small smile*), 2 (*medium smile*), and 3 (*large smile*).

*Maturity and immaturity.* Thirty-six participants rated the pictures from 0 (*least mature*) to 10 (*most mature*). They read: "We realize that you have little to go by, but we are interested precisely in what features look mature and which do not, so please give it your best shot." Twenty-nine participants completed the same task, except that *mature* was replaced by *immature*. These two dimensions were added to test whether increased familiarity might be part of a halo effect that makes people rate attractive others higher on a number of desirable personality characteristics (Langlois et al., 2000; see also Eagly, Ashmore, Makhijani, & Longo, 1991).

*Distinctiveness.* Finally, 27 participants rated the distinctiveness of each of the faces on a scale ranging from 0 (*Least distinctive = I know plenty of people who look just like this*) to 10 (*Most distinctive = I do not know anyone who looks like this*). Distinctiveness is often used as a proxy for prototypicality because it seems to be more meaningful to respondents (Cohen & Carr, 1975; Halberstadt & Rhodes, 2000).

## Results

I computed, for each picture and type of rating, the average of scores provided, thus creating for each of the 80 stimuli a mean score of attractiveness ($n = 34$), familiarity ($n = 40$), unfamiliarity ($n = 18$), maturity ($n = 36$), immaturity ($n = 29$), smiling ($n = 8$), and distinctiveness ($n = 27$). Agreement between judges, assessed through intraclass correlation coefficients (Shrout & Fleiss, 1979), was satisfactory ($\alpha > .75$, $p < .0001$), except for the ratings of immaturity ($\alpha = -.16$, *ns*), which were therefore not included in subsequent analyses. The correlations between these various scores, over the 80 faces, are presented in Table 1.

First, I replicated the correlation observed by Langlois et al. (1994) with a more concrete operationalization of familiarity; ratings of familiarity and attractiveness were highly correlated ($r = .64$, $p < .001$). The more attractive a face was perceived to be, the more participants indicated that they might have seen that person on campus.

Second, I found that this correlation was specific to familiarity and that participants were not just rating any enriched stimulus higher on any given scale (Downs & Shafir, 1999; Mandler et al., 1987). If that had been the case, they would also have rated attractive faces higher on unfamiliarity. Instead, the most attractive faces were rated the least unfamiliar ($r = -.62$, $p < .001$), perfectly in line with the .64 correlation reported above for familiarity. I should also have observed as strong a link with any offered dimension, such as maturity. Instead, the correlation between maturity and attractiveness ($r = .29$), al-

Table 1
*Pearson Correlations Between Picture Ratings in Study 1*

| Variable | *n* | $\alpha$ | 2 | 3 | 4 | 5 | 6 | $r_{AF.X}$[a] |
|---|---|---|---|---|---|---|---|---|
| 1. Attractiveness | 34 | .94 | .64** | −.62** | .29** | .33** | −.64** | |
| 2. Familiarity | 40 | .78 | | −.78** | .00 | .02 | −.55** | |
| 3. Unfamiliarity | 18 | .79 | | | .09 | .00 | .67** | .30** |
| 4. Maturity | 36 | .89 | | | | .46** | −.15 | .66** |
| 5. Smiles | 8 | .96 | | | | | −.23* | .67** |
| 6. Distinctiveness | 27 | .81 | | | | | | .45** |

*Note.* All correlations are computed across 80 pictures.
[a] The $r_{AF.X}$ column displays correlations between attractiveness and familiarity partialing out the row's variable.
* $p < .05$. ** $p < .01$.

though statistically significant,[2] is significantly weaker than the correlation between attractiveness and familiarity (Fisher's $z = 2.85$, $p < .01$). Furthermore, the two ratings seem independent, as indicated by the fact that the correlation between familiarity and attractiveness is remarkably unaffected by the partialing out of maturity.

Third, ratings of smiles enabled me to examine whether smiles were the underlying link between attractiveness and familiarity (Baudoin et al., 2000). Although smiles did correlate with attractiveness ($r = .33$, $p < .001$), they were unconnected with ratings of familiarity ($r = .02$) or unfamiliarity ($r = .00$). Despite my failure to choose stimuli equated on their facial expression, it seems therefore implausible that the relationship I observed was attributable to smiling.

Fourth, and most central to the purpose of this article, partialing out distinctiveness ($\alpha = .81$) did not eliminate the attractiveness–familiarity link. As predicted by Langlois et al. (1994), distinctiveness correlates significantly both with attractiveness ($r = -.64$, $p < .001$; the most attractive faces being the least distinctive) and with familiarity ($r = -.55$, $p < .001$; the most distinctive faces being the least familiar). When I partialed distinctiveness out of the familiarity–attractiveness correlation, it dropped from .64 to .45. However, central to my hypothesis, the partial correlation was still significant ($p < .001$), suggesting that distinctiveness does not account for the whole effect.

### *Discussion*

This first study provides good initial support for the warm glow hypothesis. Like Langlois et al. (1994), I found a strong correlation between attractiveness and familiarity: The people who were rated the most attractive by one panel of judges were also the ones another panel of judges was most likely to say they had seen on campus. By adding new measures, I was able to show that this strong correlation was not just an undifferentiated response to enriched stimuli (Downs & Shafir, 1999; Mandler et al., 1987), nor could it be explained by whether the faces in the pictures were smiling or not (Baudoin et al., 2000).

Most important, I found that the link between attractiveness and familiarity could not be exclusively reduced to prototypicality, as has been assumed until now (e.g., Langlois et al., 1994). Whereas prototypicality and distinctiveness are clearly related to both dimensions, I observed the correlation between attractiveness and familiarity even when I partialed out distinctiveness. This first study replicated Langlois et al.'s (1994) findings but suggests that their interpretation might be incomplete. Prototypicality at best only partially mediates the relationship between attractiveness and familiarity. I propose that the other half of the picture is that individuals use their liking for the faces.

Why did we not observe a correlation between smiles and familiarity, given Baudoin et al.'s (2000) findings that smiling faces look more familiar? Whereas these authors explicitly selected smiling and nonsmiling pictures, we just included a rating of smiles to control for our possible failure to keep facial expression constant at stimulus selection. Therefore, it is possible that the mild variations in emotional display (especially because most students smile in yearbook pictures) did not exhibit a sufficient range to elicit strong affective reactions.

## Study 2: Old–New Recognition

In Study 2, I sought to replicate the "beautiful-is-familiar" effect and take it further in two significant ways. First, I wanted to see whether attractiveness could influence the actual recognition of a stimulus. Going beyond possibly vague ratings of familiarity, Study 2 investigated whether attractiveness actually increases the likelihood that an item is called "old." In contrast with Study 1, where all faces were really of strangers, Study 2 used a traditional recognition paradigm, in which a set of stimuli is first encountered and then re-presented amidst distracters for recognition. This leads to the second important contribution of Study 2. By using a traditional memory paradigm, it enables computation of false alarm and hit rates and evaluation of the impact of attractiveness on these scores. If the link between familiarity and attractiveness is entirely attributable to the prototypicality and thus lower distinctiveness of attractive faces (Light et al., 1981; Light, Kayra-Stuart, & Hollander, 1979), poorer discrimination should be observed as attractiveness increases. If, however, the increase in familiarity and recognition is attributable to the positive affect one experiences in reaction to a good-looking face, then attractive faces should indeed lead to more false alarms but also to more hits and thus not necessarily to a decrease in discrimination overall. I predict that at high levels of attractiveness, people should not exhibit lower discriminability but should rely instead on a lower criterion value when deciding whether they have seen a face before, presumably because the warm glow is giving them that extra nudge in the direction of familiarity. Furthermore, this new procedure eliminates the concern that participants in Study 1 were biased to think they knew attractive people just because they liked the idea of socializing with attractive people. Here the task was merely to indicate whether faces had been presented earlier in the session; the motivational story that one wishes for a more glamorous social life is thus a less likely candidate to explain the beautiful-is-familiar effect.

Another possible concern with the familiarity measure used in Study 1 is that it confounded familiarity with confidence. The familiarity scale was labeled in terms of confidence that one had seen each face before. Prior research has suggested that these two dimensions might be orthogonal (e.g., Busey, Tunnicliff, Loftus, & Loftus, 2000). Therefore, in Study 2, I made sure I captured both dimensions independently by using two different ratings.

---

[2] Whereas all the other correlations were observed to a similar degree for male and female pictures, the attractiveness–maturity link varied by gender: It was positive for male faces ($r = .48$, $p < .005$) but nonexistent for female faces ($r = .002$). This is at first blush surprising, given that prior research has found that immature female faces tend to look more attractive to both male and female raters (e.g., Cunningham, 1986). The most likely interpretation for this departure from published findings is that immaturity is attractive when it is manipulated implicitly through neonate features (large eyes, smooth skin, etc.), but that this technical, biological understanding of maturity is to a large extent independent from the lay, psychological understanding of maturity (a mix of self-control, reliability, experience and worldliness) that our participants were most likely responding to. It appears that this understanding of maturity as desirable correlates positively with attractiveness in men and not at all in women.

## Method

*Participants.* Fifty undergraduates (26 men, 22 women, 2 undeclared) took part in this study for course credit.

*Materials.* I ranked the 80 faces that I used in Study 1 by attractiveness. Taking every other face, I created two sets of 40 faces equivalent in attractiveness. I then swapped some faces that were equivalent in attractiveness from one set to the other so that each set was composed of 20 male faces and 20 female faces of overall equivalent attractiveness (*M*s = 5.13 and 5.06), $t(78) = 0.3$, *ns*.

The *learning set* consisted of one of the 40-picture sets presented in random order, 20 per page, with an empty box under each. Participants were asked to indicate quickly whether the person in each picture was male or female, an easy task shown to lead to shallow processing and therefore to poor memory performance (Bower & Karlin, 1974).

The *test set* was made up of all 80 pictures, presented in random order (different from the learning set). Participants indicated whether they believed they had seen the pictures during the gender-rating task by circling *old* or *new* and indicating their confidence on a 10-point scale. They were reminded that they should use the whole scale and that they had seen half of the pictures previously so should not be too conservative in their judgments. Finally, they were instructed to use their feeling of familiarity if unsure.

*Procedure.* When participants arrived in the laboratory, they were asked to indicate the gender of the faces in the learning set as soon as they had completed a consent form. Then the set was collected, and participants engaged in an unrelated task for approximately 25 min, at which point they were unexpectedly tested on their recollection of the learning set in the form of the test set.

## Results

*Recognition.* For each of the 80 pictures, I computed the proportion of participants who recognized the picture as old. For the 40 pictures in the learning phase, this was the accurate response (a *hit* in signal detection terms), whereas for the 40 new pictures this corresponded to a false recollection (a *false alarm*). I was interested in the impact of attractiveness on this probability, beyond the impact of actual presentation. To this end, as before, I used picture as my unit of analysis and conducted a linear regression analysis on this recognition probability, using as predictors the attractiveness of the picture (using the ratings from Study 1, standardized) and a dummy variable corresponding to whether the picture was old or new. I originally included an interaction term in the regression equation but found that it was not significant, $t(76) = 0.1$, *ns*, and that dropping it did not affect the $R^2$ value at all (Aiken & West, 1991). The final equation regression was highly significant, $F(2, 77) = 37.9$, $p < .001$, and accounted for nearly half of the variance ($R^2 = .496$). It took the form $P = .31 + .30\ O/N + .04\ A$, where $P$ is the proportion of participants who called a picture old, $O/N$ refers to whether the picture is old (1) or new (0), and $A$ to the standardized attractiveness score. Figure 1 captures this pattern.

*Signal detection analysis.* I computed signal detection statistics (Tanner & Swets, 1954) for each participant on the basis of their hit and false alarm rates. The average separation parameter ($d'$) was not lower for the 40 most attractive faces ($M = 0.78$, $SD = 0.41$) than it was for the 40 least attractive faces ($M = 0.72$, $SD = 0.42$), $t(49) = 0.8$, *ns*, suggesting that respondents were not confusing attractive faces more than less attractive ones. Instead, the difference in recognition can most likely be accounted for in terms of different thresholds: The average criterion (relative to the intersection of old and new distributions; see Snodgrass & Corwin, 1988) for the 40 most attractive faces was lower ($M = 0.03$, $SD = 0.27$) than for the 40 least attractive faces ($M = 0.19$, $SD = 0.23$), $t(49) = 4.4$, $p < .001$.

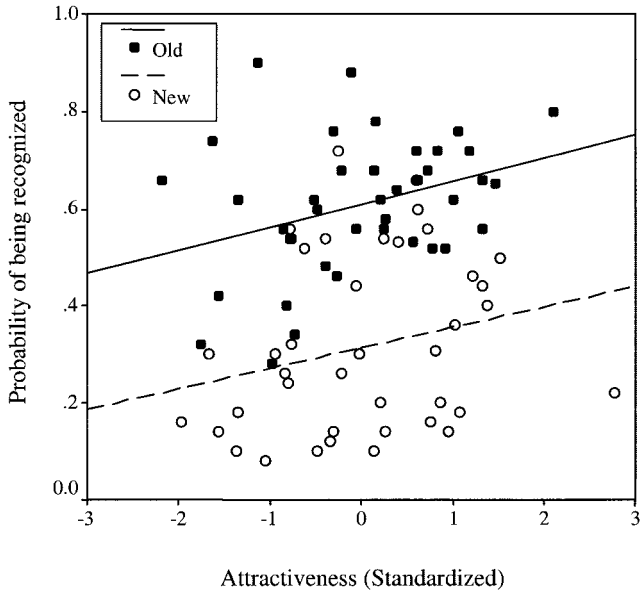


*Figure 1.* Probability of recognition by attractiveness (standardized) and old–new status.

*Confidence ratings.* Participants also indicated how confident they were about their response. This enabled us to test whether the correlation observed in Study 1 was attributable to the confounding of confidence and familiarity in the wording of the question. Contrary to this interpretation, attractiveness did not increase confidence and, if anything, decreased it ($r_{\text{overall}} = -.22$, $p < .055$; $r_{\text{hits}} = -.16$; $r_{\text{false alarms}} = -.16$; $r_{\text{misses}} = -.24$; and $r_{\text{correct rejections}} = -.24$, all *ns*).

## Discussion

As predicted, the more attractive a face is, the more likely it is to be recognized as "old," independent of its actual old–new status. Note that the parallel lines in Figure 1, reflecting the nonsignificance of the interaction, suggest that attractive faces are no more or less memorable than less attractive ones. The prototypicality hypothesis predicts that the two lines should get closer at higher levels of attractiveness because participants should be less able to discriminate between old and new attractive faces (Light et al., 1979, 1981). Instead, participants seemed just as good at recognizing attractive faces as they were with less attractive faces. This is confirmed by the signal detection analysis, which suggests that higher levels of attractiveness do not yield lower discriminability but instead lead participants to rely on a lower criterion to decide that they have seen a face before. This, I argue, is because the elicited positive affect provides the added sense of familiarity that lowers that threshold.

Thus, Study 2 provides additional evidence against a strict prototypicality interpretation of the attractiveness–familiarity link. I did not observe the lower discriminability of attractive faces to be

expected if their main feature was their greater prototypicality and lower distinctiveness. In conjunction with the finding in Study 1 that distinctiveness alone could not account for the link between familiarity and attractiveness, these results suggest that another route from attractiveness to subjective familiarity exists, one that does not necessarily involve prototypicality.

Furthermore, the confidence data indicate that attractiveness is not necessarily associated with any positive dimension. The more attractive a face was, the less confident participants were of its old–new status, independent of its actual status. This finding confirms that the results of Study 1 cannot be explained by the fact that the familiarity measure was confounded with a measure of confidence. When the two dimensions were disentangled, attractiveness impacted recognizability positively, whereas it impacted confidence negatively, and weakly at that.

## Study 3: Manipulating Attractiveness by Contrast

Instead of relying on the preexisting attractiveness of available stimuli and thus suffering from a potential ontological confound with prototypicality, in Study 3 I manipulated liking independently of the features of the stimuli and predicted that this would impact subjective familiarity. I manipulated the attractiveness of moderately attractive faces by contrasting them with either unattractive or very attractive faces (Wedell, Parducci, & Geiselman, 1987). Because the exact same pictures were used in both conditions, any difference in familiarity cannot be attributed to the inherent prototypicality of the faces.

### *Method*

*Participants.* Forty-six Princeton University students took part in this study for credit.

*Materials and procedure.* Using the ratings provided in Study 1, I divided the 80 stimulus faces used in that study into the 20 most attractive (henceforth *attractive*), the 20 least attractive (*unattractive*), and 40 in the middle (*average*). The 40 average faces were further divided into two groups of equivalent attractiveness by interspersing faces at random.

Twenty-seven participants (12 men, 15 women) completed a first version of the study in which all three sets (the two average sets and the manipulation set) were rated on attractiveness. This condition was included to verify the effectiveness of the contrast manipulation (Wedell et al., 1987). They saw an average set, then either the attractive or the unattractive set, and then the other average set. Average sets were counterbalanced across participants. Participants in this condition rated all pictures on attractiveness on a 10-point scale, with the same instructions as in Study 1.

Another 28 participants (20 men, 8 women) completed the main part of the study. As in Study 1, they were told that some of the faces were of students who were still on campus. They rated on a 10-point scale the familiarity of each face in one of the two average sets, then attractiveness for one of the extreme sets (attractive or unattractive), then familiarity again for the other average set. Again, the average sets were counterbalanced across participants.

My prediction in this study was the following: After rating the unattractive faces, the average faces should look more attractive and as a consequence should also look more familiar. By giving a set of 20 average faces before the manipulation and another 20 at the test phase (after the manipulation), I hoped to be able to control somewhat for individual preferences and response styles. I counterbalanced the 20 average faces used at the base rate and at the test phase.

### *Results*

I averaged ratings within each of the three blocks and used these ratings in my analysis.

*Preliminary analysis: Attractiveness ratings.* As a check on the contrast manipulation, I first analyzed the data provided by the participants who were only asked to rate the attractiveness of average-looking faces before and after seeing attractive or unattractive faces. As would be expected, attractive faces were rated significantly higher ($M = 5.5$) than unattractive faces ($M = 3.8$), $t(25) = 4.9$, $p < .001$. Furthermore, the contrast manipulation was effective: Average faces were rated higher when seen after unattractive faces ($M = 5.3$) than when seen after attractive faces ($M = 4.3$), $t(25) = 2.8$, $p = .01$. The average faces rated before the manipulation received virtually identical ratings ($M$s = 5.19 and 5.17). My contrast manipulation successfully impacted the attractiveness ratings of moderately attractive faces.

*Main analysis: Familiarity ratings.* Again, as a manipulation check I first made sure that the attractive faces used in the manipulation were rated more attractive ($M = 5.7$) than the unattractive faces ($M = 3.6$), $t(26) = 6.5$, $p < .001$. Then I conducted an Order × Attractiveness analysis of covariance on the familiarity ratings of the third block, using the ratings of familiarity of the first block as a covariate. The covariate was significant, $F(1, 23) = 187.2$, $p < .001$, reflecting individual differences in rating of the average faces. Furthermore, as predicted, participants rated the faces as more familiar after unattractive faces (adjusted $M = 3.3$) than after attractive faces (adjusted $M = 2.8$), $F(1, 23) = 4.8$, $p < .05$. Another way to look at the effect is to compute the difference between the test average block and the base-rate average block. An Attractiveness × Order analysis of variance (ANOVA) on this difference score yielded the predicted main effect for attractiveness, $F(1, 24) = 5.8$, $p < .05$, with an increase in familiarity after unattractive faces ($M = 0.33$), and a decrease after attractive faces ($M = -0.15$).[3]

### *Discussion*

Study 3 provides the first direct evidence for a link between attractiveness and familiarity independent of inherent prototypicality. The same average faces came to be seen as more or less familiar depending on whether they were preceded by attractive or unattractive faces. I demonstrated that this contrast manipulation had a strong impact on the perceived attractiveness of my stimuli, and therefore a straightforward interpretation for these results is that contrast led to increased liking and, as a consequence of the warm glow heuristic, to an increased feeling of familiarity. The affective reaction elicited by the pictures was taken as evidence of familiarity by the participants, who were unaware that their affective reaction was in large part determined by the context in which they saw the average faces.

[3] There was also an unexpected main effect for order, $F(1, 24) = 4.3$, $p < .05$. This suggests that the two sets of average faces used for counterbalancing, though matched on attractiveness, elicited different levels of familiarity in participants. However, because this main effect did not interact with attractiveness, I will not discuss it any further.

## Study 4: Subliminal Perception and Valenced Words

The first two studies demonstrated the need to go beyond a pure prototypicality model to explain the link between attractiveness and perceived familiarity. Study 3 demonstrated that the link remains even when prototypicality is held constant and attractiveness is manipulated by contrasting average stimuli with extreme stimuli taken at either end of the valence range. This supports my hypothesis that there exists a warm glow heuristic by which positive affect is used as an indicator of familiarity in the absence of other cues. Until now, however, I have limited positive affect to aesthetic pleasure, and to be able to claim that the effect goes beyond reactions to beauty I would need to provide a different manipulation of positive affect. I proposed the existence of the warm glow heuristic on the basis of the predicate that there exists not only a beautiful-is-familiar effect but also a more general good-is-familiar bias. Study 4 proposed to extend the range of the investigation and to demonstrate the role of the warm glow heuristic with a new type of stimulus. Whereas the prototypicality hypothesis has been mainly studied in the context of facial attractiveness (Langlois et al., 1994) and, by extension, of the prototypicality of simple category exemplars (Halberstadt & Rhodes, 2000), the warm glow heuristic can be applied to other types of positive affect, not just visual but also lexical (see also Garcia-Marques & Mackie, 2000, 2001). Positive words, for example, should seem more familiar than neutral or negative words, even if there is no reason to believe that positive words are more prototypical.

Participants in Study 4 were led to believe that they had seen some words during a bogus subliminal exposure session and were asked to guess which they had seen from a number of test words by relying on experienced familiarity. Thus, as in Studies 1 and 3, participants thought that they had had exposure to some of the stimuli whereas they were in reality all new, and any recognition would be a false alarm. This was done once again to tap into participants' subjective familiarity and to license their expression of familiarity for items that they did not explicitly recognize as old. Furthermore, by using a fully computerized version of this study, I was able to randomize stimuli individually for each participant as well as measure the latency in making recognition judgments.

### *Method*

*Participants.* Thirty-five undergraduate students participated in this study for course credit.

*Materials.* I selected words from a list used by Kitayama (1991) and added some, to have 20 positive (e.g., *charm*, *glory*), 20 neutral (e.g., *stamp*, *track*) and 20 negative (e.g., *ugly*, *crime*) words. Two words, which differed in length and frequency from the remaining 58, had to be dropped from the analysis.[4] All the remaining words had fewer than seven letters and ranged in frequency from 8 to 66 appearances per million words in Kučera and Francis' (1967) corpus. To get a sense of what that means, consider that less than 4% of words in the corpus appear more than 66 times, but they account for 74% of the corpus; in contrast, over 80% of the words appear less than 8 times, but they constitute less than 10% of the corpus. It is important to note that frequency did not differ by valence, $F(2, 55) = 1.5$, *ns*. To make sure these 35-year-old ratings still had some validity, I correlated them with their frequency of occurrence in an Internet search[5] and found that the two correlated reliably ($r_{N=58} = .37$, $p < .005$). Using these words, I then created a program to deliver the cover story and then administer both the bogus subliminal exposure phase and the test phase.

*Procedure.* Under the guise of a memory study for subliminally perceived stimuli, participants first watched the screen for 30 s while a fixation *X* in the middle of the screen alternated with strings of *X* or & (allegedly masks following actual words) flashing at random locations on the screen. After a practice trial, participants were presented with 60 words, in different random order for each participant, and indicated by pressing one of two labeled keys on the computer keyboard whether they thought they might have seen the word (*Yes*) or not (*No*). The instructions insisted that they had indeed seen half of the words and that although they would obviously not be able to recognize any of the words with confidence "since they were presented below the threshold of conscious perception," they should identify roughly half the words, taking their best guess and using their general sense of familiarity when reading the words to guide their response.

### *Results*

*Manipulation check.* Four judges rated the valence of the 58 valid words, presented in random order, on a scale from –5 to +5. I averaged these ratings across judges, yielding three nonoverlapping ranges in the expected order: negative (−4.75, −2.00), neutral (−0.75, 1.75), and positive (2.75, 4.50). The difference between the means of the three groups was highly significant, $F(2, 55) > 484$, $p < .001$.

*Main analysis.* I computed, for each of the 58 words, the proportion of participants who called a word "old" (overall $M = .47$, $SD = .10$). As predicted, positive words were more likely to be erroneously recognized ($M = .52$, $SD = .12$) than either neutral words ($M = .45$, $SD = .09$) or negative words ($M = .44$, $SD = .09$), $F(2, 55) = 3.2$, $p < .05$. When I predicted the proportion of old by valence (coded as a linear contrast), controlling for frequency using linear regression, I found that the linear contrast was a marginally significant predictor, $t(55) = 1.98$, $p = .053$, whereas frequency was not, $t(55) = 1.3$, *ns*.[6] Note also that the correlation between the proportion of old for each word and its valence as rated by the four judges was $r = .28$ ($p < .05$).

*Reaction times.* I also recorded how long it took participants to rate each word as old or new. I computed the average reaction time across subjects for each word, and found no difference based on valence ($F < 1$, even when the reaction times were log transformed) with participants overall taking a little over a second to respond ($M = 1{,}116$ ms, $SD = 163$). Furthermore, average reaction time did not correlate with the proportion of participants calling the word "old" ($r_{n=60} = .05$, *ns*). This casts doubt on the possibility that liked stimuli appear more familiar because they are attended to longer.

---

[4] After the completion of the study, I realized there was an oversight in some of the positive words added to complete Kitayama's (1991) list: The words *freedom* and *diploma*, both positive, were longer than the other 58 words, all under seven letters, and their frequency was problematic. *Freedom* appeared 128 times, which is nearly twice the most represented word in the original list. *Diploma* mysteriously does not appear in the Kučera and Francis (1967) million-word corpus, making it impossible to control for its frequency.

[5] Internet search conducted on March 17, 2002 (http://www.google.com).

[6] When *freedom* is included (see Footnote 4), the linear contrast for valence is still marginally significant, $t(56) = 1.96$, $p = .056$.

### *Discussion*

Participants were more likely to believe they had been exposed subliminally to positive words than either neutral or negative words. This demonstrates the use of the warm glow heuristic beyond the beautiful-is-familiar effect and as part of a more general good-is-familiar effect. Positive words elicit a positive affective reaction, and this positive affect, in the absence of any other cue, is taken as an indication of subjective familiarity. Consequently, a word that elicits a positive reaction is more likely to be called "old." Study 4 extends the scope of my investigation away from attractive faces to positive stimuli more generally. The fact that I obtained an effect akin to the one observed in Studies 1–3 with nonface stimuli provides further evidence that what is distinctive about attractive faces need not be their prototypicality but instead their capacity to elicit positive affect in their viewer.

It is worth noting that participants in Study 4 had very little to go on when trying to make recognition judgments, because all words were in reality new, and the only familiarity they allegedly should have experienced came from a somewhat disconcerting bogus subliminal session. Under such unfavorable conditions, individuals might be particularly likely to abandon the earnest and systematic use of effortful scheme-matching strategies and rely instead on such things as the warm glow heuristic (Schwarz, 1990; Schwarz & Clore, 1988). Under more favorable conditions, it would be expected that people would rely less on the warm glow heuristic for previously encountered stimuli than on their actual recollection of these stimuli. This possible moderating role of task difficulty was explored in the next study.

## Study 5: When Recognition Is Easy

Whereas Study 1 showed the beautiful-is-familiar effect in the case where all faces were really new, Study 2 showed that even in an actual recognition task, the likelihood that a given stimulus yields a hit or a false alarm was influenced by its attractiveness. However, even in Study 2, we made it relatively hard for participants to rely on their actual memories: (a) Participants were just asked to indicate whether each face was male or female at learning, a manipulation known to yield shallow encoding (Bower & Karlin, 1974); (b) they never knew they would be tested for memory later; and (c) they were distracted with a number of filler tasks in the 20-min delay between learning and testing. In this context, it is impressive that on average 65% of their responses were correct. I wondered whether participants rely on attractiveness only in such challenging conditions, under *uncertainty*, to use the term familiar in the heuristic literature, and whether the effect would disappear as they had better recollection of the stimuli.

This moderation effect of task difficulty has been suggested by existing research. Baudoin et al. (2000) showed a reliance on smiles only when the judgment required becomes finer than is possible with the information readily available: In their data, the smile effect is apparent only for the recognition of nonfamous faces or for fine-tuned judgments of familiarity. It seems that in the conditions where systematic processing is not enough, the heuristic is called for. This is reminiscent of Zajonc's (1980) suggestion that when fine discrimination is needed, affect can be recruited as an auxiliary source of information (p. 169). Furthermore, Light et al. (1979, 1981) found that typical faces led to both more hits and false alarms under unfavorable conditions (e.g., short exposure at learning), whereas they led to fewer hits and more false alarms under more favorable conditions, a pattern that they acknowledged being at a loss to explain. One reason for this pattern may be that participants were relying on the warm glow heuristic in the unfavorable conditions. Study 5 endeavors to show that reliance on attractiveness decreases as it becomes easier to recognize stimuli.

### *Method*

*Participants.* Fifty Stanford University undergraduates were approached on campus and asked to rate the 80 faces used in Studies 1 and 2 on the same attractiveness scale. Fifty-nine Stanford undergraduates came to the laboratory in exchange for partial course credit to take part in the memory part of this study.

*Procedure.* The procedure was similar to that of Study 2, with the exception that a manipulation of depth of encoding was introduced. Three conditions were created to generate increasing levels of ease and accuracy. Condition 1 (*Delay + No Warning*) replicated exactly the procedure of Study 2. In Condition 2 (*Delay + Warning*), instead of rating gender, participants were told when they first saw the faces that they would be asked to remember them later and that they should pay particular attention to features. Finally, in Condition 3 (*No Delay + Warning*), the procedure was the same as the latter, except that the 25-min filler was eliminated altogether, and participants received the memory task immediately after studying the faces.

### *Results*

*Manipulation checks.* The mean ratings of attractiveness collected with 50 participants at Stanford correlated at .84 ($p < .001$), with the ratings used in Studies 1–3 and collected at Princeton with 34 participants. Furthermore, the depth of encoding manipulation was successful in increasing the accuracy of the participants, because it climbed from an average of 65% (as in Study 2) in Condition 1 to 72% in Condition 2 and finally to 79% in Condition 3, $F(2, 55) = 10.7$, $p < .001$.

*Main analysis.* To facilitate intergroup comparisons, I used participant as the unit of analysis. I computed a binary logistic regression equation for each participant predicting whether a picture was called "new" or "old" (coded 0/1) with that picture's real new–old status (coded −1/+1), the standardized attractiveness of the picture, and the product of these two variables capturing the interaction term. The coefficients from these binary logistic regressions were then entered as individual scores in a regular ANOVA. (The parameter covariance matrix could not be computed for 1 participant in Condition 3 who achieved perfect accuracy and who therefore could not be included in this analysis.)

As is apparent in Table 2, the effect of the picture's actual status was significant overall, $F(1, 57) = 32.4$, $p < .001$, but did not differ by condition, $F(2, 55) = 1.2$, *ns*. Likewise, the effect of attractiveness was significant overall, $F(1, 57) = 4.1$, $p < .05$, but it did not differ by condition, $F(2, 55) = 0.5$, *ns*. The interaction coefficient was not significantly different from zero overall, $F(1, 57) < 0.01$, *ns*, but showed the predicted significant linear trend from Conditions 1–3, $F(1, 55) = 4.4$, $p < .05$. In particular, although the average interaction coefficient did not differ significantly from zero in Conditions 1 and 2, it did in Condition 3, $t(17) = 2.4$, $p < .05$. To illustrate this pattern, note that although the correlation between standardized attractiveness and likelihood of being called "old" was .12 for new faces and .26 for old faces

Table 2
*Unstandardized Partial Coefficients in Individual Binary Logistic Regression Equations in Study 5*

| | Descriptive statistics | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | O/N | | Attr | | Attr × O/N | | Intercept | |
| Condition | *n* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* |
| 1. No warning + delay | 20 | −2.46 | 4.37 | 0.11 | 0.43 | 0.09 | 0.46 | 0.14 | 0.57 |
| 2. Warning + delay | 20 | −2.44 | 1.60 | 0.05 | 0.40 | 0.08 | 0.42 | 0.82 | 0.95 |
| 3. Warning + no delay | 18 | −4.19 | 5.23 | 0.19 | 0.43 | −0.18 | 0.32 | 0.99 | 1.06 |
| Total | 58 | −2.99 | 4.00 | 0.11 | 0.41 | 0.00 | 0.42 | 0.64 | 0.94 |

| | Inferential statistics | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | O/N | | Attr | | Attr × O/N | | Intercept | |
| Comparison | *df*s | *F* | *p* | *F* | *p* | *F* | *p* | *F* | *p* |
| Overall difference from zero | (1, 57) | 32.4 | < .001 | 4.1 | < .05 | 0.01 | .97 | 26.6 | < .001 |
| Omnibus between groups | (2, 55) | 1.2 | .32 | 0.5 | .59 | 2.7 | < .08 | 5.1 | < .01 |
| Linear contrast | (1, 55) | 1.8 | .19 | 0.4 | .56 | 4.4 | < .05 | 9.0 | < .005 |

*Note.* O/N = old/new; Attr = attractiveness.

in Condition 1, it was .26 for new faces and .08 for old faces in Condition 3.

### *Discussion*

Study 5 explored the conditions under which the beautiful-is-familiar phenomenon is most likely to be observed, replicating the effect under the challenging conditions of earlier studies. However, when it was easy for participants to remember the faces because they had been instructed to remember them and they did not have time to forget them (Condition 3), the effect was much weaker. Even in this easy condition, the effect was still observable among distractors, as one would predict, resulting in a significant interaction in that condition between attractiveness and actual old–new status. These results demonstrate that people are most likely to rely on the warm glow heuristic under conditions of uncertainty. I return to this issue below.

## General Discussion

This project presents a systematic investigation of the fact that liking can lead to familiarity. I contrasted two explanations for the fact that liked stimuli, and attractive faces in particular, tend to feel more familiar than more neutral stimuli, a phenomenon I termed the *beautiful-is-familiar* effect. Although I embraced the generally accepted notion that attractive stimuli seem more familiar by virtue of being prototypical, I argued that this only accounted for part of the effect. Instead, I proposed that people also possess the warm glow heuristic, by which familiarity is assessed on the basis of positive affect. In the absence of other information, people answer the question "Have I seen *X* before?" by asking themselves "Do I like *X*?"—a classic case of the attribute substitution that is assumed to underlie much heuristic use (Kahneman & Frederick, 2002). I presented five studies to demonstrate this point. Studies 1 and 2 showed that a simple prototypicality account was insufficient to account for the entire beautiful-is-familiar effect. In Study 3, I showed that faces could be made more familiar by manipulating their attractiveness by contrast while their features remained the same. I then switched to word stimuli in Study 4, which enabled me to have more experimental control as well as to show the warm glow heuristic at work in a more general good-is-familiar effect, of which the beautiful-is-familiar effect would be just one example: Positive words seemed more familiar to participants than neutral or negative words. In Study 5, I showed that the beautiful-is-familiar phenomenon is most likely to occur when people lack a clear recollection of the stimuli under study. Overall, these five studies provide a good starting point for the study of the warm glow heuristic. Below I review some of the questions left open by these studies that future research should address.

### *When Do People Use the Warm Glow Heuristic?*

Like other heuristics, the warm glow heuristic should be most useful when other information or modes of knowledge are unavailable. It should be unnecessary when people can rely on overlearned schemas (e.g., one's mother's face) or specific episodic memories ("this is the blonde guy with glasses I talked to the last time I came into this store"). In fact, in these situations of relative certainty, it would most likely be overridden by other factors. But in the confusing world of social interaction, people often face much harder recognition tasks. For example, they need to recognize others quickly after very brief exposures ("did we already get introduced?"), out of context (a school acquaintance in a nightclub), or among a vast array of distractors (a face in a crowd). In such situations, where memory traces themselves might be insufficient to make a quick and precise memory judgment, affective reactions can be called in for assistance. If a face "feels right"; if there is something pleasant about it; in short, if people like it, then they are more likely to assume they have seen it before. In the absence of such a positive reaction, they are left with little basis for judgment and are more likely to think this is their first encounter.

People may thus rely on the warm glow heuristic most when they do not have much to go by. In Study 5, when it was easy to

recognize the old faces, participants did not show much influence of attractiveness. Only with the new faces that elicited no easy recognition or in the conditions where recognition was more challenging did attractiveness seem to play a role. In this respect, the warm glow heuristic does not differ from other heuristics, which come in handy mostly under uncertainty, that is, when information or cognitive resources are insufficient to compute an answer head on and a shortcut is more efficient. Kahneman (2000) recently stated explicitly that he and Tversky had always thought of heuristics in the framework of a dual-process theory (Chaiken & Trope, 1999; see also Stanovich & West, 2000).

Although attractiveness can provide that extra nudge toward a feeling of familiarity or lower the threshold for recognition (as in Study 2), it is important to keep in mind that it is only one among a host of other factors that go into the recognition equation. In Study 2, for example, where participants could rely on their actual memory of the faces, attractiveness only explains an additional 4.1% of the variance above the 45.5% already accounted for by old–new status. Even when attractiveness was the only thing they could rely on (as in Study 1), it still accounted for only a little more than 40% of the variance. Thus, although I would like to claim that the warm glow heuristic warrants study because of its intriguing nature and its theoretical significance, it is evident that it is one of many factors in people's daily recognition judgments.

### *Perceptual Fluency*

As I describe in the introduction, one possible common denominator for attractiveness and familiarity is perceptual fluency (Jacoby & Dallas, 1981). Perceptual fluency is most likely involved in the prototypicality-related component of the beautiful-is-familiar effect, in that prototypes may be easier to process, yielding both high attractiveness and high familiarity judgments. But the affect-based component of the phenomenon, the warm glow heuristic, is less likely to involve perceptual fluency. In Study 4, for example, the more positive a word was, the more often it was falsely recognized. To interpret this effect in terms of perceptual fluency, one would have to assume that positive words are more fluent than neutral negative words. The research available on this issue (e.g., Pratto & John, 1991) provides more support for the opposite view, dubbed *automatic vigilance*, suggesting that negative stimuli have the potential to grab people's attention more than any others and thus, one would surmise, are processed more fluently. If fluency were driving the effect of Study 4, one would therefore predict that negative words would feel more familiar; instead, and in line with the warm glow heuristic, positive words felt most familiar to the respondents. Therefore, although it is possible to interpret the effects observed in Studies 1–3 in terms of perceptual fluency, it is more difficult to do so in Study 4. This suggests that although fluency is undoubtedly a factor in many recognition tasks and can feed into the warm glow heuristic when it leads to aesthetic pleasure, it is not necessary for the warm glow to occur, as was illustrated in the case of semantic valence.

### *Are Unpleasant Stimuli Unfamiliar?*

Up until this point I have assumed that the warm glow heuristic would yield a linear pattern, such that just as pleasant stimuli feel more familiar than neutral stimuli, neutral stimuli in turn should feel more familiar than unpleasant stimuli. This is the pattern that I tested by using linear regression models in Studies 1, 2, and 5 and by fitting a linear contrast in Study 4. In all of these studies, a linear model seemed to fit the data satisfactorily. The pattern of means in Study 4, however, where the positive words seem to differ from the negative or neutral words, which were not that different from one another, suggests that an asymmetric model may be as viable. Indeed, if one substitutes the contrast weights $(-1, -1, +2)$ to the linear contrast $(-1, 0, +1)$ in the regression presented above, one finds that this new contrast is also a significant predictor, $t(55) = 2.3$, $p = .03$. Despite the slightly higher degree of significance of this latter predictor, it is difficult to claim that the model fits the data much better: Whereas the linear model predicts 11% of the variance, the asymmetric model predicts 13% of the variance.

Titchener (1910) assumed a linear relationship between recognition and affect, such that lack of recognition is experienced as strangeness, an "uneasy restlessness, distinctly unpleasant" (p. 410). More recently, Berlyne's (1971) arousal interpretation of the exposure effect posited that novel stimuli may be unpleasant when they elicit excessive arousal in an organism. For the purposes of this discussion, it would follow that in the same way that liking might lead to more familiarity, disliking should lead to less familiarity. However, in recent years it has become increasingly apparent that it may be simplistic to think of positive and negative affect as two ends of a spectrum; instead, the two may fluctuate independently and essentially represent two orthogonal dimensions (Cacioppo & Berntson, 1994). It follows from this view that a heuristic based on positive affect need not be connected with negative affect. In support of the unique status of positive affect in familiarity, Monahan et al. (2000) showed that viewing previously seen stimuli could increase one's mood, but they never claimed that viewing new stimuli should lower one's mood.

I reanalyzed Studies 1–3 to test how much they support this asymmetric model. In Study 1, the correlation between familiarity and attractiveness ($r_{\text{overall}} = .64$) is larger in the top half of the attractiveness distribution ($r = .50$, $p < .001$) than in the lower half ($r = .25$, $p > .10$), as would be predicted by the asymmetric model, but this difference is not significant ($z = 1.26$, $p = .2$). In Study 2, the slope for attractiveness was actually slightly steeper when pictures ranged from least attractive to average (for the bottom 40, $b = .08$, $p > .10$) than when they ranged from average to most attractive (for the top 40, $b = .02$, $p > .5$), a pattern that does not fit the asymmetric model. The results of Study 3 do fit the asymmetric model if one considers that when average faces are made more attractive by contrast, they are rated higher than at baseline (difference $M = 0.33$, which is significantly different from 0), $t(12) = 3.1$, $p < .01$, whereas when they are made less attractive they pretty much stay at baseline (difference $M = -0.15$, which does not differ significantly from 0), $t(14) = .7$, *ns*. Also, as I mention above, the results of Study 4 fit an asymmetric pattern as well as they fit a linear pattern.

Although the results of Studies 1, 3, and 4 seem to fit an asymmetric pattern, they were not designed to test this pattern against a simpler, linear model and therefore lack the necessary power (e.g., for the *z* test in Study 1) to tease the two apart. In the interests of parsimony, it seems more reasonable at this point to assume that the warm glow heuristic applies similarly across the whole spectrum of valence, yielding a linear pattern, but future

research should investigate the possibility that it may be essentially based on positive affect, which would yield the asymmetric pattern.

### *Why Should People Possess the Warm Glow Heuristic?*

Things that people are familiar with tend to be liked. From an evolutionary point of view, it makes sense that such a heuristic would be selected for, because the things people would see most of the time and survive would be harmless and even possibly conducive to survival (for an evolutionary take on exposure effects, see Bornstein, 1989). Thus, familiarity would be associated with approach, whereas unfamiliarity would be associated with fear and avoidance. With time, these basic behavioral responses would become attitudes, and people would associate familiarity with things they like, unfamiliarity with things they dislike (Mandler, 1984). Titchener (1910) imagined such an origin for the warmth of the feeling of familiarity:

> We may suppose that it is a weakened survival of the emotion of relief, of fear unfulfilled. . . . The bodily attitude which expresses recognition is, on this view, still the attitude of relief from tension, of ease and confidence. (p. 408)

Zajonc (2001) recently interpreted the mere exposure effect as a pairing through repetition of a stimulus with positive consequences, to wit, the absence of negative consequences. For both Titchener and Zajonc, the familiar is liked because people know it doesn't bite: What doesn't kill us is liked better the second time.

Studies of relationship formation show how proximity and similarity are large determinants of both friendships and romantic relationships (Berscheid, 1998). Both features are highly predictive of familiarity, so liking is again associated with prior exposure. Another factor is people's rosy perception of their life experience. People tend to think that a majority of elements in their life are positive (Kanouse & Hanson, 1972) and that their experiences, outcomes and expectations are superior (Taylor & Armor, 1996), so pleasant stimuli may seem representative (Kahneman & Tversky, 1972) of the type of experience that one would have encountered. If I believe that most of the people I know are good-looking, I am more likely to recognize a beautiful face than I am to recognize a plain one. At a more basic level, repeated subliminal exposure to a stimulus is enough to increase liking of that stimulus (Zajonc, 1968, 1998, 2001), to elicit a response of the facial muscles associated with smiling (Harmon-Jones & Allen, 2001), and to elevate mood in general (Monahan et al., 2000). After experiencing this effect enough times, it is possible that perceivers develop an implicit association between liking a stimulus and prior exposure to it.

### *The Warm Glow Heuristic in Neurological Context*

Neurologists have reported numerous intriguing cases of disjunction between recognition and familiarity that can help illuminate the warm glow heuristic. The processing of faces seems to hold a particular place in the human brain, as demonstrated by revealing lesion studies (Feinberg, 2001). Patients suffering from *prosopognosia*, for example, recognize objects in general but have difficulty assigning proper identity to faces. They know a face when they see one but do not know whose face it is. In contrast, patients suffering from *Capgras syndrome* (Capgras & Reboul-Lachaux, 1923) recognize who the person in front of them should be but lack the feeling of familiarity that normally accompanies encountering a known face. As a result, patients often come to believe quite earnestly that their spouse or relative have been replaced by doubles, a distressing case of delusional misidentification. One proposed explanation for the Capgras syndrome (Alexander, Stuss, & Benson, 1979) is that it results from a lesion of the connections between the temporal lobe, involved in memory, and the limbic system, involved in emotion, pain, pleasure, and motivation. Ellis and Young (1990) proposed that two routes exist to visual facial recognition. On the one hand, the central route involves explicit recognition of facial identity by matching the face with a stored memory. When this route is damaged, patients suffer from prosopognosia. On the other hand, the dorsal route involves the emotional significance of the faces, and connects the visual areas with the limbic system. Damage here is dealt with through the development of the Capgras delusion.

The reliance on the limbic system in face recognition circles back to Zajonc's (1980) proposition that face recognition might be based on *preferenda* (the features of a stimulus that determine affective reaction) and highlights the deeply rooted connections between the neurological structures leading to familiarity and those involved in positive affective reactions. Maybe the Capgras syndrome represents an extreme breakdown of the warm glow heuristic following a lesion to the affective system. People normally do not need positive affect to assist in the recognition of overlearned faces such as one's spouse or friend. However, positive affect is always there in the background, and its absence seems so uncanny to patients that assuming the loved one was replaced by a double becomes a more credible alternative. This hypothesis is of course highly speculative, but the study of patient populations suffering from memory or affective disorders might help cast new light on the study of the warm glow heuristic.

## Conclusion

This article contributes to a growing literature on the role of affect in basic mental processes. The warm glow heuristic is part of the vast repertoire of cognitive tools that enables people to make sense and organize their social world, especially when they have limited cognitive resources or information at their disposal. To be sure, as with any heuristic, it can lead to errors, but it should also help when all else fails. Many questions remain, but this first foray into the aesthetics of recognition gives important insights into the informative role of beauty in everyday life.

## References

Aiken L. S., & West, S. G. (1991). *Multiple regression: Testing and interpreting interactions.* London: Sage.

Alexander, M. P., Stuss, D. T., & Benson, D. F. (1979). Capgras syndrome: A reduplicative phenomenon. *Neurology, 29,* 334–339.

Alley, T. R., & Cunningham, M. R. (1991). Averaged faces are attractive, but very attractive faces are not average. *Psychological Science, 2,* 123–125.

Baudoin, J. Y., Gilibert, D., Sansone, S., & Tiberghien, G. (2000). When the smile is a cue to familiarity. *Memory, 8,* 285–292.

Berlyne, D. E. (1971). *Aesthetics and psychobiology.* New York: Appleton-Century-Crofts.

Berscheid, E. (1998). Attraction and close relationships. In D. T. Gilbert, S. T. Fiske, & G. Lindzey (Eds.), *The handbook of social psychology* (Vol. 2, pp. 193–281). New York: McGraw-Hill.

Bless, H., Bohner, G., Schwarz, N., & Strack, F. (1990). Mood and persuasion: A cognitive response analysis. *Personality and Social Psychology Bulletin, 16,* 331–345.

Bomba, P. C., & Siqueland, E. R. (1983). The nature and structure of infant form categories. *Journal of Experimental Child Psychology, 35,* 294–328.

Bonnano, G. A., & Stillings, N. A. (1986). Preference, familiarity, and recognition after repeated brief exposures to random geometric shapes. *American Journal of Psychology, 99,* 403–415.

Bornstein, R. F. (1989). Exposure and affect: Overview and meta-analysis of research, 1968–1987. *Psychological Bulletin, 106,* 265–289.

Bornstein, R. F., & D'Agostino, P. R. (1992). The attribution and discounting of perceptual fluency: Preliminary tests of a perceptual fluency/attributional model of the mere exposure effect. *Social Cognition, 12,* 103–128.

Bornstein, R. F., & D'Agostino, P. R. (1994). Stimulus recognition and the mere exposure effect. *Journal of Personality and Social Psychology, 63,* 545–552.

Bower, G. H., & Karlin, M. B. (1974). Depth of processing of faces and recognition memory. *Journal of Experimental Psychology, 103,* 751–757.

Busey, T. A., Tunnicliff, J., Loftus, G. R., & Loftus, E. F. (2000). Accounts of the confidence–accuracy relation in recognition memory. *Psychonomic Bulletin & Review, 7,* 26–48.

Cacioppo, J. T., & Berntson, G. G. (1994). Relationship between attitudes and evaluative space: A critical review, with emphasis on the separability of positive and negative substrates. *Psychological Bulletin, 115,* 401–423.

Capgras, J. M. J., & Reboul-Lachaux, J. (1923). L'illusion des "sosies" dans un délire systématisé chronique [Doppelgänger illusion in a chronic systematized delirium]. *Bulletin de la Société Clinique de Médecine Mentale, 11,* 6–16.

Chaiken, S., & Trope, Y. (1999). *Dual-process theories in social psychology.* New York: Guilford Press.

Cohen, M. E., & Carr, W. J. (1975). Facial recognition and the von Restorff effect. *Bulletin of the Psychonomic Society, 6,* 383–384.

Cunningham, M. R. (1986). Measuring the physical in physical attractiveness: Quasi-experiments on the sociobiology of female facial beauty. *Journal of Personality and Social Psychology, 50,* 925–935.

Downs, J. S., & Shafir, E. (1999). Why some are perceived as more confident and more insecure, more reckless and more cautious, more trusting and more suspicious, than others: Enriched and impoverished options in social judgment. *Psychonomic Bulletin & Review, 6,* 598–610.

Eagly, A. H., Ashmore, R. D., Makhijani, M. G., & Longo, L. C. (1991). What is beautiful is good, but . . . A meta-analytic review of research on the physical attractiveness stereotype. *Psychological Bulletin, 110,* 109–128.

Ellis, H. D., & Young, A. W. (1990). Accounting for delusional misidentifications. *British Journal of Psychiatry, 157,* 239–248.

Feinberg, T. E. (2001). *Altered egos: How the brain creates the self.* Oxford, England: Oxford University Press.

Franks, J. J., & Bransford, J. D. (1971). Abstraction of visual patterns. *Journal of Experimental Psychology, 90,* 65–74.

Garcia-Marques, T., & Mackie, D. M. (2000). The positive feeling of familiarity: Mood as an information processing regulation mechanism. In H. Bless & J. P. Forgas (Eds.), *The message within: The role of subjective experience in social cognition and behavior* (pp. 240–261). Philadelphia: Psychology Press/Taylor & Francis.

Garcia-Marques, T., & Mackie, D. M. (2001). The feeling of familiarity as a regulator of persuasive processing. *Social Cognition, 19,* 9–34.

Gerard, H. B., Green, D., Hoyt, M., & Conolley, E. S. (1973). Influence of affect on exposure frequency estimates. *Journal of Personality and Social Psychology, 28,* 151–154.

Gordon, P. C., & Holyoak, K. J. (1983). Implicit learning and generalization of the "mere exposure" effect. *Journal of Personality and Social Psychology, 45,* 492–500.

Halberstadt, J., & Rhodes, G. (2000). The attractiveness of nonface average: Implications for an evolutionary explanation of the attractiveness of average faces. *Psychological Science, 11,* 285–289.

Harmon-Jones, E., & Allen, J. J. B. (2001). The role of affect in the mere exposure effect: Evidence from psychophysiological and individual differences approach. *Personality and Social Psychology Bulletin, 27,* 889–898.

Jacoby, L. L., & Dallas, M. (1981). On the relationship between autobiographical memory and perceptual learning. *Journal of Experimental Psychology: General, 110,* 306–340.

Jacoby, L. L., & Kelley, C. (1987). Unconscious influences of memory for a prior event. *Personality and Social Psychology Bulletin, 13,* 314–336.

Jacoby, L. L., Kelley, C., Brown, J., & Jasechko, J. (1989). Becoming famous overnight: Limits on the ability to avoid unconscious influences of the past. *Journal of Personality and Social Psychology, 56,* 326–338.

Jacoby, L. L., Kelley, C. M., & Dywan, J. (1989). Memory attributions. In H. L. Roediger III & F. I. M. Craik (Eds.), *Varieties of memory and consciousness: Essays in honour of Endel Tulving* (pp. 391–422). Hillsdale, NJ: Erlbaum.

Jacoby, L. L., & Whitehouse, K. (1989). An illusion of memory: False recognition influenced by unconscious perception. *Journal of Experimental Psychology: General, 118,* 126–135.

Johnston, W. A., Dark V. J., & Jacoby, L. L. (1985). Perceptual fluency and recognition judgments. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 11,* 3–11.

Kahneman, D. (2000). A psychological point of view: Violations of rational rules as a diagnostic of mental processes. *Behavioral and Brain Sciences, 23,* 681–683.

Kahneman, D., & Frederick, S. (2002). Representativeness revisited: Attribute substitution in intuitive judgment. In T. Gilovich, D. Griffin, & D. Kahneman (Eds.), *Heuristics and biases : The psychology of intuitive judgment* (pp. 49–81). New York: Cambridge University Press.

Kahneman, D., & Tversky, A. (1972). Subjective probability: A judgment of representativeness. *Cognitive Psychology, 3,* 430–454.

Kanouse, D. E., & Hanson, L. R. (1972). Negativity in evaluations. In E. E. Jones, D. E. Kanouse, H. H. Kelley, R. E. Nisbett, S. Valins, & B. Weiner (Eds.), *Attribution: Perceiving the causes of behavior* (pp. 27–46). Morristown, NJ: General Learning Press.

Kitayama, S. (1991). Impairment of perception by positive and negative affect. *Cognition and Emotion, 5,* 255–274.

Kučera, H., & Francis, W. N. (1967). *Computational analysis of present-day American English.* Providence, RI: Brown University Press.

Kunst-Wilson, W. R., & Zajonc, R. B. (1980, February 1). Affective discrimination of stimuli that cannot be recognized. *Science, 207,* 557–558.

Langlois, J. H., Kalakanis, L., Rubenstein, A. J., Larson, A., Hallam, M., & Smoot, M. (2000). Maxims or myths of beauty? A meta-analysis and theoretical review. *Psychological Bulletin, 126,* 390–423.

Langlois, J. H., & Roggman, L. A. (1990). Attractive faces are only average. *Psychological Science, 1,* 115–121.

Langlois, J. H., Roggman, L. A., & Musselman, L. (1994). What is average and what is not average about attractive faces? *Psychological Science, 5,* 214–220.

Light, L. L., Hollander, S., & Kayra-Stuart, F. (1981). Why attractive people are harder to remember. *Personality and Social Psychology Bulletin, 7,* 269–276.

Light, L. L., Kayra-Stuart, F., & Hollander, S. (1979). Recognition mem-

ory for typical and unusual faces. *Journal of Experimental Psychology: Human Learning and Memory, 5,* 212–228.
Mandler, G. (1982). The structure of value: Accounting for taste. In M. S. Clark & S. T. Fiske (Eds.), *Affect and cognition: The 17th Annual Carnegie Symposium on Cognition* (pp. 3–36). Hillsdale, NJ: Erlbaum.
Mandler, G. (1984). *Mind and body: The psychology of emotion and stress.* New York: Norton.
Mandler, G., Nakamura, Y., & Van Zandt, B. J. (1987). Nonspecific effects of exposure on stimuli that cannot be recognized. *Journal of Experimental Psychology: Learning, Memory and Cognition, 13,* 646–648.
Meyer, L. B. (1956). *Emotion and meaning in music.* Chicago: University of Chicago Press.
Monahan, J. L., Murphy, S. T., & Zajonc, R. B. (2000). Subliminal mere exposure: Specific, general, and diffuse effects. *Psychological Science, 11,* 462–473.
Moreland, R. L., & Zajonc, R. B. (1977). Is stimulus recognition a necessary condition for the occurrence of exposure effects? *Journal of Personality and Social Psychology, 35,* 191–199.
Moreland, R. L., & Zajonc, R. B. (1979). Exposure effects may not depend on stimulus recognition. *Journal of Personality and Social Psychology, 37,* 1085–1089.
Moreland, R. L., & Zajonc, R. B. (1982). Exposure effects in person perception: Familiarity, similarity, and attraction. *Journal of Experimental Social Psychology, 18,* 395–415.
Perrett, D. I., May, K. A., & Yoshikawa, S. (1994, March 17). Facial shape and judgments of female attractiveness. *Nature, 368,* 239–242.
Pratto, F., & John, O. P. (1991). Automatic vigilance: The attention-grabbing power of negative social information. *Journal of Personality and Social Psychology, 61,* 380–391.
Reber, R., & Schwarz, N. (1999). Effects of perceptual fluency on judgments of truth. *Consciousness and Cognition, 8,* 338–342.
Reber, R., Winkielman, P., & Schwarz, N. (1998). Effects of perceptual fluency on affective judgments. *Psychological Science, 9,* 45–48.
Rhodes, G., Halberstadt, J., & Brajkovich, G. (2001). Generalization of mere exposure effects to average composite faces. *Social Cognition, 19,* 57–70.
Rhodes, G., & Tremewan, T. (1996). Averageness, exaggeration, and facial attractiveness. *Psychological Science, 7,* 105–110.
Rosch, E. (1978). Principles of categorization. In E. Rosch & B. B. Lloyd (Eds.), *Cognition and categorization* (pp. 312–322). Hillsdale, NJ: Erlbaum.
Schwarz, N. (1990). Feelings as information: Informational and motivational functions of affective states. In E. T. Higgins & R. Sorrentino (Eds.), *Handbook of motivation and cognition: Foundations of social behavior* (Vol. 2, pp. 527–561). New York: Guilford Press.
Schwarz, N., & Clore, G. L. (1988). How do I feel about it? The informative function of affective states. In K. Fiedler & J. Forgas (Eds.), *Affect, cognition and social behavior: New evidence and integrative attempts* (pp. 44–62). Toronto, Ontario, Canada: Hogrefe.
Schwarz, N., & Clore, G. L. (1996). Feelings and phenomenal experiences. In E. T. Higgins & A. Kruglanski (Eds.), *Social psychology: A handbook of basic principles* (pp. 433–465). New York: Guilford Press.
Shrout, P. E., & Fleiss, J. L. (1979). Intraclass correlations: Uses in assessing rater reliability. *Psychological Bulletin, 86,* 420–428.
Slovic, P., Finucane, M., Peters, E., & MacGregor, D. G. (2002). The affect heuristic. In T. Gilovich, D. Griffin, & D. Kahneman (Eds.), *Heuristics and biases: The psychology of intuitive judgment* (pp. 397–420). New York: Cambridge University Press.
Snodgrass, J. G., & Corwin, J. (1988). Pragmatics of measuring recognition memory: Applications to dementia and amnesia. *Journal of Experimental Psychology: General, 117,* 34–50.
Solso, R. L., & McCarthy, J. E. (1981). Prototype formation of faces: A case of pseudo-memory. *British Journal of Psychology, 72,* 499–503.
Solso, R. L., & Raynis, S. A. (1979). Prototype formation from imagined, kinesthetically and visually presented geometric figures. *Journal of Experimental Psychology: Human Perception and Performance, 5,* 701–712.
Stanovich, K. E., & West, R. F. (2000). Individual differences in reasoning: Implications for the rationality debate? *Behavioral and Brain Sciences, 23,* 645–665.
Strauss, M. S. (1979). Abstraction of prototypical information by adults and 10-month-old infants. *Journal of Experimental Psychology: Human Learning and Memory, 5,* 618–632.
Tanner, W. P., & Swets, J. A. (1954). A decision-making theory of visual detection. *Psychological Review, 61,* 401–409.
Taylor, S. E., & Armor, D. A. (1996). Positive illusions and coping with adversity. *Journal of Personality, 64,* 873–898.
Titchener, E. B. (1910). *A textbook of psychology.* New York: Macmillan.
Tversky, A., & Kahneman, D. (1974, September 27). Judgments under uncertainty: Heuristics and biases. *Science, 185,* 1124–1131.
Wedell, D. H., Parducci, A., & Geiselman, R. E. (1987). A formal analysis of ratings of physical attractiveness: Successive contrast and simultaneous assimilation. *Journal of Experimental Social Psychology, 23,* 230–249.
Whittlesea, B. W., & Williams, L. (2000). The source of feelings of familiarity: The discrepancy–attribution hypothesis. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 26,* 547–565.
Whittlesea, B. W., & Williams, L. (2001). The discrepancy–attribution hypothesis: I. The heuristic basis of feelings and familiarity. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 27,* 3–13.
Zajonc, R. B. (1968). Attitudinal effects of mere exposure. *Journal of Personality and Social Psychology, 9,* 1–27.
Zajonc, R. B. (1980). Feeling and thinking: Preferences need no inferences. *American Psychologist, 35,* 151–175.
Zajonc, R. B. (1998). Emotions. In D. T. Gilbert, S. T. Fiske, & G. Lindzey (Eds.), *The handbook of social psychology* (pp. 591–632). New York: McGraw-Hill.
Zajonc, R. B. (2001). Mere exposure: A gateway to the subliminal. *Current Directions in Psychological Science, 10,* 224–228.

Received August 16, 2002
Revision received June 18, 2003
Accepted July 7, 2003 ■