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Kellen Mrkva and Leaf Van Boven

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Salience Theory of Mere Exposure: Relative Exposure Increases Liking, Extremity, and Emotional Intensity

Kellen Mrkva

Columbia Business School and University of Colorado Boulder

Leaf Van Boven

University of Colorado Boulder

We propose and support a salience explanation of exposure effects. We suggest that repeated exposure to stimuli influences evaluations by increasing salience, the relative quality of standing out from other competing stimuli. In Experiments 1 and 2, we manipulated exposure, presenting some stimuli 9 times and other stimuli 3 times, 1 time, or 0 times, as in previous mere exposure research. Exposure increased liking, replicating previous research (Zajonc, 1968), and increased salience, made evaluations more extreme, and made stimuli more emotionally intense. Across experiments, results of multiple mediation models and a causal chain of experiments supported the idea that salience explains these exposure effects. Fluency and apprehension, 2 constructs that have been invoked to explain mere exposure, accounted for less of these effects according to the mediation models and the chain of experiments. We next manipulated relative exposure and absolute exposure orthogonally, finding that relative exposure increases liking more than absolute exposure. Stimuli presented 9 times were liked more when other stimuli in the context were presented less than 9 times than when the other stimuli were presented more than 9 times (Experiment 4). Whereas absolute exposure had no significant effect in Experiment 4, relative exposure increased liking, extremity, and emotional intensity. In Experiment 5, a direct manipulation of salience increased liking, evaluative extremity, and emotional intensity. These results suggest that salience partially explains effects previously attributed to absolute “mere” exposure.

Keywords: mere exposure, salience, attitudes, emotion, fluency

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The idea that simple repeated exposure increases liking is foundational to psychological science. Mere exposure appears in nearly every introductory textbook and has influenced several theories (Griggs & Christopher, 2016; Pettigrew & Tropp, 2006; Schwarz, 2011). Mere exposure has many broad implications, suggesting a straightforward way to improve intergroup relations (Zebrowitz, White, & Wieneke, 2008), increase romantic attraction (Moreland & Beach, 1992), and improve attitudes toward a product, brand, or politician (Baker, 1999; Fang, Singh, & Ahluwalia, 2007; Grush, McKeough, & Ahlring, 1978). More than 100 experiments across over 50 years of research have demonstrated that people like

stimuli presented more frequently more than stimuli presented less frequently (Bornstein, 1989; Montoya, Horton, Vevea, Citkowicz, & Lauber, 2017; Zajonc, 1968); but how “mere” is mere exposure?

We suggest that repeated exposure influences evaluations because it makes stimuli stand out from other competing stimuli in their surroundings. We suggest, in other words, that mere exposure effects are largely attributable to salience rather than mere absolute exposure. Furthermore, this salience explanation implies that repeated exposure not only increases liking but also increases evaluative extremity and emotional intensity.

Mere Exposure

Several theories have been proposed to explain the mere exposure effect. According to one class of theories, exposure effects are explained by increased fluency, the ease of processing stimuli (Bornstein & D’Agostino, 1994; Fang et al., 2007; Reber, Winkielman, & Schwarz, 1998; Winkielman & Cacioppo, 2001; Winkielman, Schwarz, Fazendeiro, & Reber, 2003). One fluency theory suggests that repeated exposure makes stimuli easier to process, which directly increases liking because people like things that are easy to process (Reber et al., 1998). A different theory, called the fluency/attribution model, proposes that fluency increases liking only under some circumstances, namely, when people infer that a stimulus is easy to process because they like it (Bornstein & D’Agostino, 1994). According to this explanation, exposure increases liking more when people are unaware of exposure (Bornstein & D’Agostino, 1994), in which

 Kellen Mrkva, Center for Decision Sciences, Columbia Business School, and Department of Psychology and Neuroscience, University of Colorado Boulder; Leaf Van Boven, Department of Psychology and Neuroscience, University of Colorado Boulder.

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Correspondence concerning this article should be addressed to Kellen Mrkva, Center for Decision Sciences, Columbia Business School, 3022 Broadway, 316E Uris, New York, NY 10027. E-mail: km3386@columbia.edu

case people tend to attribute fluency to liking rather than exposure. More recent research, however, suggests that exposure effects may be smaller or absent when exposure is outside of awareness (de Zilva, Vu, Newell, & Pearson, 2013; Newell & Bright, 2003; Newell & Shanks, 2007; Stafford & Grimes, 2012).

Several other theories, including Zajonc's original explanation, propose that exposure increases liking because exposure reduces people's apprehension toward novel stimuli. According to these accounts, people have evolved to be wary of novel stimuli, even when they are neutral and not inherently threatening. This initial apprehension subsides after repeated exposure without any negative reinforcement (Berlyne, 1970; Harrison, 1977; Zajonc, 1968).

Although these two classes of theory posit different explanations, both assert that it is absolute mere exposure frequency that increases liking by increasing fluency or decreasing apprehension. According to meta-analyses, however, these existing theories do not account for several key findings (Bornstein, 1989; Montoya et al., 2017). They fail to explain why exposure has a larger effect when many stimuli are displayed within the same presentation compared with when each stimulus appears in its own presentation (Bornstein, 1989). They also fail to explain why exposure increases liking more for neutral and positive stimuli than for negative stimuli (Harrison, 1977; Meskin, Phelan, Moore, & Kieran, 2013; Siegel & Weinberger, 2012). If exposure has different effects on negative than positive stimuli, this would pose a problem for existing theories that imply a unidirectional increase in liking (Harrison, 1977; Reber et al., 1998; Zajonc, 1968).

We suggest that salience plays an important, neglected role in mere exposure effects. The salience explanation is consistent with the unexplained findings described above. We predict that traditional mere exposure manipulations increase the salience of high exposure stimuli, and this heightened salience largely accounts for exposure effects. Because salience is a relative quality of standing out compared with other stimuli in the environment, this salience explanation also implies that relative exposure should influence evaluations more than absolute exposure.

Salience

Salience is the extent to which objects stand out, capture attention, and contrast from other competing stimuli within the environment or context (Borji, Sihite, & Itti, 2013; Fiske & Taylor, 1991; Taylor & Fiske, 1978; van der Lans, Pieters, & Wedel, 2008). Salience is a relative quality shaped by the perceiver's representation of a stimulus in relation to the surrounding external or internal environment. Thus, it is influenced not only by stimulus characteristics, but also perceiver characteristics and perceiver-stimulus interactions (Blumenthal-Dramé, Hanulíková, & Kortmann, 2017; Guido, 2001; Kanan, Tong, Zhang, & Cottrell, 2009). For example, a rare car on the highway might be salient to car enthusiasts yet blend in with surrounding cars for other passersby. Objects interfere with one another's salience more when they are presented close together in time and space than when they are presented far apart (Grice, Boroughs, & Canham, 1984; Kihara, Yagi, Takeda, & Kawahara, 2011; Theeuwes, 1995). Even subtle differences such as wearing glasses or new shoes can increase salience, though features that make a stimulus highly unusual, different from surrounding stimuli to a larger extent (e.g., pink hair), or a singleton (i.e., different from all surrounding stimuli) are

especially salient (Perazzi, Krähenbühl, Pritch, & Hornung, 2012; Taylor & Fiske, 1978).

Fluency is the subjective feeling of ease associated with processing information. Subjective feelings of fluency and disfluency pervade nearly every form of mental activity including retrieving memories, encoding memories, simulating past and future events, listening to sounds, and reading words (Alter & Oppenheimer, 2009). Fluency influences several types of judgments including judgments about whether or not a statement is true (Reber & Schwarz, 1999), whether a city is large (Hertwig, Herzog, Schooler, & Reimer, 2008), whether a word is familiar (Whittlesea, 1993), and whether an object is likable (Reber et al., 1998). In some cases, salient objects such as a friend in a red shirt surrounded by strangers might be easier to process and recognize (Alter & Oppenheimer, 2009). In other cases, salient objects such as words that are misspelled or written with unusual fonts are more disfluent than surrounding objects (Mead & Hardesty, 2018). Recent research has shown that judgments of fluency and salience generally have weak associations with one another (Mead & Hardesty, 2018; Mrkva, Cole, & Van Boven, 2019; Rummer, Scheweppe, & Schwede, 2016).

Salience is positively associated with, yet distinct from, vividness and brightness (Kardes, 2002; Taylor & Fiske, 1978). Vividness and brightness are absolute qualities. Vividness is impacted by the brightness and clarity of sights, sounds, and mental imagery (Baddeley & Andrade, 2000; Valdez & Mehrabian, 1994). Salience and vividness are dissociable. When one dull blue dress is surrounded by dozens of vivid red dresses on a sales rack, the blue dress is more salient despite being less vivid (Itti, Koch, & Niebur, 1998). Though vividness, brightness, and fluency themselves are absolute, judgments of these qualities, like all subjective judgments, are influenced by relative characteristics (Lockhead, 2004; Stewart, Brown, & Chater, 2005). However, unlike salience which is an inherently relative construct, the constructs of vividness, brightness, and fluency are meant to refer to absolute qualities.

Relative Exposure Increases Salience

We propose that salience largely explains exposure effects. Stimuli that are presented relatively frequently stand out from other objects in the environment. We posited that salience increases how much people like a wide array of stimuli.

In a typical mere exposure experiment, people view a slideshow in which the number of times each stimulus is presented is manipulated. For example, two stimuli may be presented nine times each, two presented three times each, and two presented one time each (Moreland & Beach, 1992; Moreland & Zajonc, 1977; Wiggs, 1993; Zajonc, Crandall, Kail, & Swap, 1974; Zajonc, Swap, Harrison, & Roberts, 1971). Some stimuli are presented more frequently than others. According to recent research on visual perception, frequently presented objects usually "pop out" and appear more perceptually distinctive relative to novel and less frequently presented stimuli (Brascamp et al., 2008; Brascamp, Pels, & Kristjánsson, 2011; Kristjánsson & Campana, 2010; Maljkovic & Nakayama, 1994; Sigurdardottir, Kristjánsson, & Driver, 2008; Wang, Cavanagh, & Green, 1994). We conducted a Pilot study to test the supposition that repeated exposure increases salience within a typical mere exposure paradigm (it did; see the online supplemental material).

Exposure increases salience in many contexts (Brascamp et al., 2008, 2011; Kristjánsson & Campana, 2010; Wang et al., 1994). In some cases, however, novel stimuli pop out more than familiar stimuli, although previous research suggests this is caused by expectancy violation and salience, not reduced exposure (Diliberto, Altarriba, & Neill, 2000; Vachon, Hughes, & Jones, 2012). When one novel stimulus is surrounded by many familiar stimuli, the one novel stimulus attracts more attention and stands out because it is a singleton that contrasts from all the other stimuli (Diliberto et al., 2000). Or, when one stimulus is presented many times in a row followed by a novel stimulus, the novel stimulus stands out because it is unexpected and contrasts from the rest (Vachon et al., 2012). However, when exposure is isolated from expectancy violation, singleton status, and contrast from surrounding stimuli, as in mere exposure and many other paradigms, exposure should increase salience as we found in the Pilot.

Two observations from the mere exposure literature support the idea that salience explains the mere exposure effect. First, relative exposure influences evaluations beyond absolute exposure. This observation, which has not previously been brought to light, can be illustrated by comparing across experiments in previous research. Consider people's evaluations of Chinese characters that were presented nine times in several different experiments (Moreland & Zajonc, 1977; Wiggs, 1993; Zajonc et al., 1971, 1974). In some of these experiments, the characters presented nine times were in a slideshow in which all the other Chinese characters were presented fewer times (e.g., one time and three times). In other experiments, some of the Chinese characters in the slideshow were presented more than nine times (e.g., 81 times). Comparing across experiments, participants liked the characters presented nine times more when the other characters in the slideshow appeared fewer times (e.g., three times), compared with when there were other stimuli in the slideshow presented more frequently (e.g., 81 times; Wiggs, 1993; Zajonc et al., 1974, 1971).¹ This suggests that relative exposure may impact evaluations, even when absolute mere exposure is equivalent (see Table 1).

Second, according to a meta-analysis, effects of mere exposure are larger when many stimuli appear in the same presentation (called heterogeneous presentation experiments) than when only one stimulus appears in each presentation (called homogeneous

presentation experiments; Bornstein, 1989). When exposure is manipulated among stimuli within the same presentation, this likely manipulates the relative salience of stimuli in addition to absolute exposure. In contrast, when only one stimulus is presented, that stimulus is likely salient whether it is presented many times or few times, because there are no other stimuli competing for salience (Harrison & Crandall, 1972; Kastner, de Weerd, Desimone, & Ungerleider, 1998). According to a meta-analysis, there was a moderate effect size of mere exposure on increased liking in heterogeneous presentation experiments, but no significant effect in homogeneous presentation experiments (Bornstein, 1989).

Finally, there is evidence that salience increases liking from other literatures (Kirby, 2014; Milosavljevic, Navalpakkam, Koch, & Rangel, 2012; Morvinski & Amir, 2018). For example, making nonsense words and abstract images more salient increases how much people like them (Kirby, 2014). Additionally, people like salient labels more than nonsalient labels (e.g., "heads" more than "tails"; Morvinski & Amir, 2018). According to previous research, people like salient objects partly because they associate salient objects with the self and because salient stimuli receive more mental rehearsal (Kirby, 2014; Mrkva & Van Boven, 2017). This prediction that salience increases liking is a key supposition underlying our hypothesis that relative exposure increases liking.

Relative Exposure Increases Extremity and Emotional Intensity

The salience explanation of mere exposure implies two new predictions. One is that if relative exposure increases salience, it should increase the evaluative extremity of more frequently presented stimuli. Previous research suggests that salience makes evaluations more extreme (Granot, Balcetis, Schneider, & Tyler, 2014; Sadler & Tesser, 1973). Making neutral, positive, or negative objects more salient should, therefore, cause evaluations to become more extreme (i.e., further away from neutral evaluations; Brauer, Judd, & Gliner, 1995; Downing, Judd, & Brauer, 1992; McArthur & Solomon, 1978; Sadler & Tesser, 1973). Salience can make evaluations more extreme through more processing and mental attention (Tesser, 1978) and through attribution and associative learning processes in which salient stimuli are paired more strongly with a given evaluation than nonsalient stimuli (Downing et al., 1992; Jones, Olson, & Fazio, 2010). For example, economic recessions and upturns are more likely to be attributed to a salient stimulus such as a prime minister rather than less salient yet important causes, all else equal, making evaluations of the salient

Table 1
Liking Ratings of Chinese Character Stimuli Presented Nine Times in Previous Exposure Research

Absolute exposure frequency	Other stimuli in slideshow frequency	Relative exposure	Liking
9 times	243 times	Lowest	-0.02
9 times	81 times	Low	0.20
9 times	3 times	High	0.77

Note. Relative exposure may influence liking above and beyond absolute "mere" exposure frequency. Liking was on a 7-point scale ($-3 = \text{dislike}$, $3 = \text{like}$). We used the averages from all experiments in which Chinese characters were presented nine times in a slideshow while others were presented three times, 81 times, or 243 times (in most cases, we use reported means, but in a few cases we had to approximate means based on figures because exact means were not provided). The table compares across different experiments and journal articles, so liking differences are not necessarily because of relative exposure.

¹ These results should be interpreted with caution given that they compare data across different experiments. The differences are suggestive but are not necessarily caused by relative exposure differences. For this comparison, we used experiments in the Montoya et al. (2017) meta-analysis in which some Chinese characters were presented nine times while others were presented at lower levels of exposure or very high levels of exposure (81 or 243; i.e., Wiggs, 1993; Zajonc et al., 1974; Zajonc et al., 1971). We only did this comparison with Chinese characters presented nine times, because other stimuli and other exposure levels have not been used in studies where the same exposure level is relatively lower than others in the slideshow in some studies and relatively higher than others in the slideshow in other studies.

stimulus more extreme (Pryor & Kriss, 1977; Taylor & Fiske, 1978).

Therefore, we hypothesized that by making objects more salient, relative exposure would increase evaluative extremity, in addition to increasing liking. The reasoning underlying these hypothesized effects of relative exposure on evaluative extremity and liking were based on distinct, independent mechanisms described above. When combining the prediction that relative exposure increases liking with the prediction that relative exposure increases extremity, it implies that relative exposure should increase liking for positive and neutral stimuli more than for negative stimuli. This is because increased liking and increased extremity would both produce more extreme positive ratings for neutral and positive stimuli. For negative stimuli, however, the two effects would offset each other, because increased extremity would make evaluations more negative and increased liking would make evaluations more positive. Therefore, we expected relative exposure to increase evaluative extremity, to increase liking, and to increase liking for positive stimuli more than negative stimuli.

Another new prediction implied by the salience explanation of mere exposure is that relative exposure would increase emotional intensity. Making objects less salient decreases the emotional intensity of these objects (Bantick et al., 2002; Valdez & Mehrabian, 1994; Van Dillen & Koole, 2007). Conversely, salient objects attract attention (Itti et al., 1998), which increases emotional intensity partly by enhancing mental representations of stimulus features such as contrast and by inhibiting activation of visual and emotional brain areas in response to unattended stimuli (Kastner et al., 1998; Mrkva, Westfall, & Van Boven, 2019; Todd, Cunningham, Anderson, & Thompson, 2012). These processes by which salience increases emotional intensity are different from the processes by which salience increases liking and evaluative extremity. Therefore, we expected relative exposure, by increasing salience, would have three simultaneous and partly independent effects, increasing liking, evaluative extremity, and emotional intensity.

The Present Studies

We tested these hypotheses in five experiments. In Experiments 1 and 2, we manipulated exposure as in previous mere exposure research (Zajonc et al., 1971; Zajonc et al., 1974). We tested whether repeated exposure increases salience and whether salience would mediate the exposure effects. We also tested whether exposure increases evaluative extremity and emotional intensity. In Experiment 2, we also used a manipulation wherein participants search repeatedly for one randomly determined image, which increases salience (Mrkva et al., 2019), to test whether this would increase liking, extremity, and intensity.

In Experiments 3 and 4, we tested whether relative exposure influences liking, evaluative extremity, and emotional intensity more than absolute exposure, a prediction that was derived from the notion that salience, a relative quality, may mediate these exposure effects. In Experiment 3, we manipulated absolute exposure by using a between-persons exposure manipulation. We compared the effect size of this manipulation to a within-persons exposure manipulation. In Experiment 4, we presented stimuli at three levels of exposure, which varied between persons (9, 18, and 27 exposures for some participants; 9, 3, and 1 for others). We examined the effects of relative exposure and absolute exposure,

expecting that relative exposure would increase liking, evaluative extremity, and emotional intensity even when controlling for absolute exposure. Additionally, we tested whether relative exposure would increase liking for positive stimuli more than negative stimuli.

In Experiment 5, we tested whether another manipulation of salience—distinct from exposure—increases liking, evaluative extremity, and emotional intensity. We made one stimulus stand out from others in the scene either by displaying it in dark gray while the other stimuli were light gray or by displaying it in light gray while the other stimuli were dark gray.

Across studies, we intended to create a chain of experiments supporting the proposed causal path in which experimentally increasing exposure increases salience and experimentally increasing salience increases liking, evaluative extremity, and emotional intensity (Spencer, Zanna, & Fong, 2005). This causal chain of experiments could lend support not only to the predictions that exposure increases liking, extremity, and intensity but also for the idea that salience partially explains those effects.

All data files and analysis scripts are publicly available online at https://osf.io/q6a3b/?view_only=dca757b6691b47ad935191882aa3de09. Supplemental materials are available at https://osf.io/h34kb/?view_only=dca757b6691b47ad935191882aa3de09. Across all experiments, we sought samples of at least 100 participants in each condition, resulting in approximately 100 participants in within-participants experiments and larger samples in between-participants experiments. All experiments had Institutional Review Board (IRB) approval.

Experiment 1

In Experiment 1, we manipulated exposure as in previous mere exposure research (Moreland & Beach, 1992; Moreland & Zajonc, 1977; Zajonc et al., 1974, 1971). Stimuli were presented in a slideshow nine, three, and zero times. We hypothesized that exposure would increase liking, as in previous research. We also hypothesized that exposure would increase salience, evaluative extremity, and emotional intensity. We predicted that salience would at least partially account for these effects.

Method

Participants. There were 116 American adults from Amazon Mechanical Turk (MTurk) who participated online in exchange for \$1.25. Sixteen dropped out of the study before viewing all three slideshows (resulting $N = 100$; 50 women, $M_{\text{age}} = 36.39$). Participants who were using a smartphone or tablet to access the survey link were prevented from participating. The sample had equal numbers of men and women. Though we only measured gender and age, samples from MTurk are relatively diverse, especially compared with samples of undergraduate students (Henrich, Heine, & Norenzayan, 2010; Mason & Suri, 2012).

Procedure. Participants viewed slideshows consisting of several stimuli. Exposure was manipulated by presenting some stimuli more frequently than others. At the beginning of the experiment, participants were told that the study was investigating memory. Additional instructions were added to disguise the reason for different levels of exposure. Specifically, participants were told that this research was investigating whether people remember

words after being exposed to them just a few times and whether people require more exposures to remember shapes, artwork, and symbols.

Participants completed the following procedure with three different sets of stimuli: Chinese characters, Turkish words, and segments of an abstract art painting (Appendix S1 in the online supplemental materials, available online, displays all stimuli). These three sets of stimuli were used because they are among the most common in previous mere exposure research; thus, making our results comparable (Montoya et al., 2017). The order of the three blocks of stimuli was counterbalanced.

In each block, participants first viewed a slideshow consisting of four stimuli from the same stimulus set. Two stimuli were presented nine times, two were presented three times, and four were not presented (stimulus exposure frequency was randomly determined). All participants saw a total of 24 slides, with slide order randomly determined. Stimuli were presented for 1.0 s each time they appeared and a 1.0 s fixation cross was presented between each stimulus.

After the slideshow, participants answered several questions about all eight stimuli in the set, answering each question about all eight stimuli before proceeding to the next question. The liking measure consisted of the two most common liking items in mere exposure research (Montoya et al., 2017): “How much do you like this image?” ($-3 = \text{dislike}$, $0 = \text{neutral}$, $3 = \text{like}$; Zajonc, 1968) and “For each [character/word], indicate the extent to which you think it means something good or bad” ($-3 = \text{very bad}$, $0 = \text{neutral}$, $3 = \text{very good}$).² These two items were averaged for all analyses across experiments ($b = 0.42$, $p < .001$).³ Evaluative extremity was computed as deviation from the neutral midpoint of the liking scale, as in previous research (Downing et al., 1992; Powell & Fazio, 1984).

To assess perceived emotional intensity, participants were asked “How emotionally intense is each image” and “How intense was your emotional reaction to each image” (both scales: $1 = \text{not at all intense}$; $9 = \text{extremely intense}$; Mrkva et al., 2019). The two items were averaged ($b = 0.59$, $p < .001$).

Participants also reported stimulus salience: “As the images were presented, how salient was this image? In other words, how much did it stand out in this context?” ($1 = \text{not at all salient}$, $7 = \text{extremely salient}$). This item was adapted from previous research that found positive associations between subjective ratings of salience, visual features such as color contrast, and eye fixations (Borji et al., 2013).

We also included measures of alternative mediating processes of perceived fluency and apprehension. We used a common fluency measure used in previous research, “How easy is each image to process” ($1 = \text{difficult to process}$, $7 = \text{easy to process}$; Auschaitrakul & Mukherjee, 2017; Han, Sohn, & Yoo, 2015; Kramer & Min Kim, 2007; Lee & Aaker, 2004; Lin & Shen, 2012; Mollen, Holland, Ruiters, Rimal, & Kok, 2016; Mrkva, Travers, & Van Boven, 2018; Yoon, Sarial-Abi, & Gürhan-Canli, 2012).⁴ We measured apprehension by asking, “To what extent does each image make you feel uneasy?” ($1 = \text{not at all}$, $5 = \text{extremely}$; Makros & McCabe, 2003; McNair, Lorr, & Droppleman, 1971; Norman, Windell, Lynch, & Manchanda, 2011; Thompson, Sebastianelli, & Murray, 2009). Participants repeated this procedure of viewing a slideshow and rating stimuli, until they had viewed and rated all three sets of stimuli.

Near the end of the experiment, participants were given a memory test (Appendix S2 in online supplemental materials). All 12 stimuli that participants saw across the three slideshows were presented along with 18 foil stimuli from the same stimulus sets. Participants were asked, “Which of the below images, words, and characters did you see in the slideshows earlier?”

Finally, participants answered questions that assessed whether they were aware of the research question. These questions consisted of both an open-ended and multiple-choice version asking what they thought the experimenters were studying, as well as asking why they think some words, characters, and shapes were presented more times than others (see Appendix A). Following this, we asked participants whether they speak Mandarin or Turkish and whether they could comprehend any of the words or characters they saw, to ensure that participants did not understand the true meaning of the Chinese characters and Turkish words. We also asked participants whether they had seen any of the stimuli before, because it is possible that mere exposure effects may be larger for novel stimuli (Harrison, 1977). All participants were included in the primary analyses reported below. All effects remained significant when removing the four participants who correctly guessed the research question, when removing the two participants who could comprehend at least one of the Mandarin or Turkish words, and when removing ratings from sets in which participants had seen at least one stimulus before (see online supplemental material: https://osf.io/h34kb/?view_only=dca757b6691b47ad935191882aa3de09).

Analytical Approach

In all experiments, we analyzed data using linear mixed effect models, treating participants and stimuli as random factors to properly model error variance associated with both random factors and allow generalization across participants and stimuli (Judd, Westfall, & Kenny, 2012). Mixed effects models were conducted using the maximal random effects structure (Barr, Levy, Scheepers, & Tily, 2013), and fixed effects were estimated using Satterthwaite approximate degrees of freedom. In designs with multiple random effects modeled using mixed effects models, statistical power varies as a function of the number of participants, the number of stimuli, and the variance associated with each random factor. However, we sought sample sizes of at least 100 participants per condition and used stimuli that had low variance (that

² This second item would be confusing if not nonsensical for the art segment stimuli, so only the first liking item was used for these stimuli (Zajonc, Shaver, Tavis, & Van Kreveld, 1972).

³ This association was computed with a mixed effects model adjusting for participant and stimulus random effects. Raw correlations are not reported because they do not adjust for participant and stimulus. For all measures, we are quoting the wording that was used for abstract art stimuli. For Chinese characters, the word “image” was replaced with “character.” For Turkish words, “image” was replaced with “word.”

⁴ Because fluency and perceived emotion are subjective experiences, self-report items are most appropriate. A few studies examining fluency have used measures of accessibility (e.g., Schooler & Hertwig, 2005). However, these are less appropriate given that fluency is a subjective state which does not reflect speed (see Oppenheimer, 2008 for a thorough critique of speed and time measures of fluency). Some studies have equated speed, showing that the subjective state of fluency and fluency effects are not attributable to differences in processing speed (Reber, Meier, Ruch-Monachon, & Tiberini, 2006).

increases power; McClelland, 2000). We used at least 24 stimuli per experiment, which in designs with multiple random factors results in higher statistical power all else equal compared with designs with fewer stimuli (Brauer & Curtin, 2018; Westfall, Kenny, & Judd, 2014).

Results

To analyze the effect of exposure on each outcome variable, we computed a linear mixed effects model with fixed effects of exposure and random effects of participant and stimulus. Exposure was contrast-coded (weights in parentheses) to examine whether each variable increased with exposure (0 exposures = -1; 3 exposures = 0; 9 exposures = 1). A second contrast was included to keep the model orthogonal (3 exposures = $\frac{2}{3}$; 0 and 9 exposures = $-\frac{1}{3}$). Data files and analysis scripts for all five experiments are publicly available [here](#).

Salience. As predicted, exposure increased salience, $t(82.09) = 7.10$, $b = 0.76$, $p < .001$ (see Figure 1). Participants rated stimuli presented nine times ($M = 4.38$, $SD = 1.98$) as more salient than stimuli presented three times ($M = 3.91$, $SD = 1.90$) or zero times ($M = 2.87$, $SD = 1.91$). Simple-effects tests revealed that stimuli presented nine times were rated as significantly more salient than stimuli presented three times, $t(23.38) = 3.89$, $b = 0.47$, $p < .001$, and stimuli presented three times were more salient than those presented zero times, $t(64.59) = 5.88$, $b = 1.05$, $p < .001$.

Liking. Exposure increased liking (see Figure 1). Participants reported that they liked stimuli they were exposed to nine times ($M = 0.30$, $SD = 1.55$) more than stimuli they were exposed to three times ($M = 0.05$, $SD = 1.46$) or zero times ($M = -0.28$, $SD = 1.43$), $t(37.55) = 6.62$, $b = 0.27$, $p < .001$. This replicates previous research on mere exposure (Zajonc, 1968). Simple-effects tests revealed that liking ratings were greater after nine exposures compared with three, $t(23.55) = 2.73$, $b = 0.23$, $p = .012$, and after three exposures compared with zero, $t(29.35) = 3.53$, $b = 0.30$, $p = .001$.

Liking was positively associated with evaluative extremity ($b = 0.17$, $p < .001$), described below, and with perceived emotional intensity ($b = 0.15$, $p < .001$). The effect of exposure on liking remained significant when controlling for evaluative extremity and perceived emotional intensity, $t(93.38) = 5.02$, $b = 0.18$, $p < .001$.

Evaluative extremity. Exposure also made evaluations more extreme. Evaluative extremity was computed as deviation from the neutral midpoint of the liking scale (i.e., the absolute value of liking ratings; Downing et al., 1992). Exposure increased evaluative extremity, $t(24.17) = 3.35$, $b = 0.09$, $p = .002$ (see Figure 1). Participants had more extreme evaluations of stimuli presented nine times ($M = 1.18$, $SD = 0.93$) compared with stimuli presented three times ($M = 1.11$, $SD = 0.88$) or zero times ($M = 1.02$, $SD = 0.86$). Simple-effects tests showed that the difference between three exposure and zero exposures was significant, $t(72.89) = 3.09$, $b = 0.12$, $p = .003$. The difference between nine exposures and three exposures was not significant, $t(39.70) = 1.03$, $b = 0.05$, $p = .308$.

Evaluative extremity was weakly associated with perceived emotional intensity ($b = 0.07$, $p < .001$). The effect of exposure on evaluative extremity remained significant when controlling for

liking and perceived emotional intensity, $t(26.50) = 2.32$, $b = 0.05$, $p = .028$.

Perceived emotional intensity. Exposure increased perceived emotional intensity, $t(62.15) = 6.09$, $b = 0.39$, $p < .001$ (see Figure 1). Participants had more intense emotional reactions to stimuli presented nine times ($M = 3.86$, $SD = 2.42$) than those presented three times ($M = 3.64$, $SD = 2.34$) or zero times ($M = 3.08$, $SD = 2.14$). Simple-effects tests revealed that participants rated stimuli presented nine times as significantly more emotionally intense than stimuli presented three times, $t(96.53) = 2.57$, $b = 0.23$, $p = .012$, and stimuli presented three times more intense than stimuli presented zero times, $t(44.18) = 4.56$, $b = 0.56$, $p < .001$. The effect of exposure on perceived emotional intensity remained significant when controlling for liking and evaluative extremity, $t(54.32) = 5.53$, $b = 0.30$, $p < .001$.

Mediation analyses. We hypothesized that repeated exposure increases liking, evaluative extremity, and perceived emotional intensity because it makes stimuli more salient. Exposure also increased fluency ($M_{9 \text{ exposures}} = 4.33$, $SD = 1.94$; $M_{3 \text{ exposures}} = 4.04$, $SD = 1.94$; $M_{0 \text{ exposures}} = 3.80$, $SD = 1.92$), $t(22.81) = 5.21$, $b = 0.27$, $p < .001$, and decreased apprehension ($M_{9 \text{ exposures}} = 1.77$, $SD = 1.31$; $M_{3 \text{ exposures}} = 1.88$, $SD = 1.45$; $M_{0 \text{ exposures}} = 2.00$, $SD = 1.51$), $t(46.74) = -3.31$, $b = -0.12$, $p = .002$. Therefore, it is possible that fluency or apprehension might mediate the exposure effects. Fluency was negatively associated with apprehension ($b = -.27$, $p < .001$) and positively associated with salience ($b = .18$, $p < .001$). Apprehension was not associated with salience ($b = .01$, $p = .787$).

Multiple mediation analyses were conducted to examine the hypothesis that salience mediates the effects of exposure on liking, evaluative extremity, and perceived emotional intensity. These analyses also tested whether fluency or apprehension could account for each of the exposure effects (Reber et al., 1998; Zajonc, 1968). For each outcome, a multiple mediation model with salience, fluency, and apprehension as potential mediators (5,000 bootstrapped resamples) estimated the size of three indirect effects. The mediation models were conducted from mixed effects models which accounted for variance associated with individual participants and stimuli (Rockwood & Hayes, 2017).⁵

For liking, there was an indirect effect of exposure through salience as a mediator ($ab = 0.10$, 95% confidence interval, CI [0.08, 0.13]). There were smaller indirect effects through fluency ($ab = 0.03$, 95% CI [0.02, 0.05]) and apprehension ($ab = 0.03$, 95% CI [0.02, 0.05]). A comparison of mediational paths (Preacher & Hayes, 2008) revealed that salience accounted for significantly more of the effect than did fluency (difference in indirect effects = 0.07, 95% CI [0.04, 0.09]), and apprehension (difference in indirect effects = 0.07, 95% CI [0.04, 0.10]; Table 2). This suggests that salience, fluency, and apprehension may all partially account for the effect of exposure on liking, though salience accounted for a larger portion of the variance than fluency or apprehension.

For evaluative extremity, there was an indirect effect through salience ($ab = 0.04$, 95% CI [0.03, 0.06]). The indirect effect through fluency ($ab = 0.00$, 95% CI [-0.001, 0.008]) was not

⁵ Each indirect effect controlled for exposure and the other potential mediators, following the recommendations of Preacher and Hayes (2008).

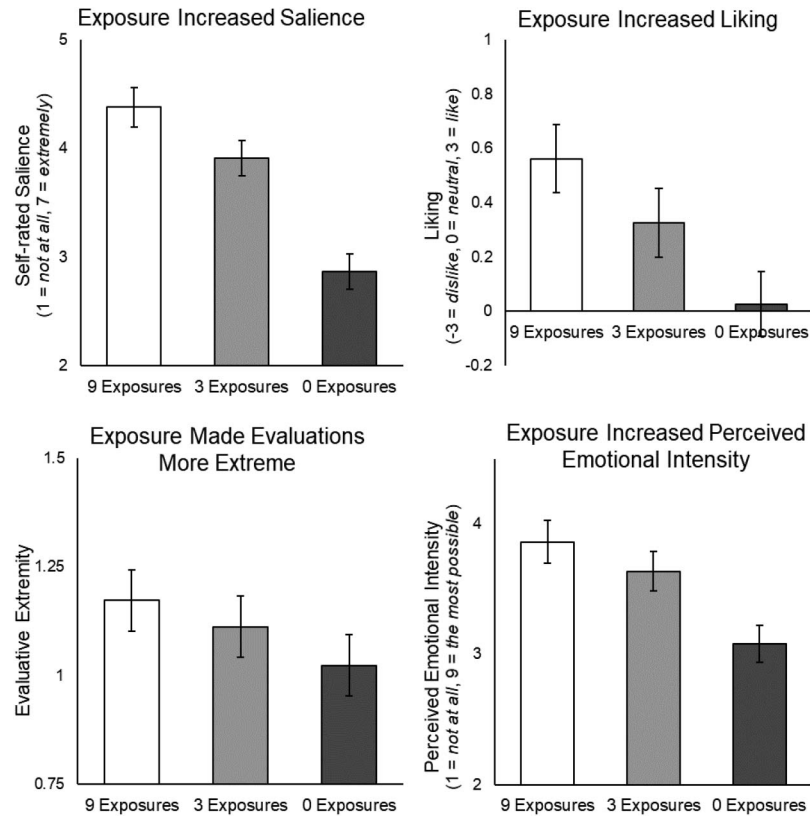


Figure 1. The effect of exposure on salience, liking, evaluative extremity, and perceived emotional intensity in Experiment 1. Error bars depict ± 1 standard error (adjusted to account for the within-participants design; Cousineau, 2005).

substantially larger than zero. The indirect effect through apprehension was negative ($ab = -0.01$, 95% CI $[-0.129, -0.003]$), meaning that exposure reduced apprehension, and lower apprehension was associated with lower evaluative extremity. If anything, the effect of exposure on apprehension suppressed the effect of exposure on evaluative extremity. A comparison of indirect effects (Preacher & Hayes, 2008) revealed that salience accounted for more of the effect of exposure on evaluative extremity than did

fluency (difference: 0.04, 95% CI $[0.03, 0.06]$) and apprehension (difference: 0.05, 95% CI $[0.04, 0.07]$).

Finally, when estimating perceived emotional intensity, there was an indirect effect through salience ($ab = 0.29$, 95% CI $[0.25, 0.33]$). There was also an indirect effect through fluency ($ab = 0.01$, 95% CI $[0.001, 0.020]$). There was a negative indirect effect through apprehension ($ab = -0.02$, 95% CI $[-0.03, -0.01]$). As with evaluative extremity, the effect of

Table 2
Testing Multiple Possible Mediators of the Effects on Key Dependent Variables

Outcome variable (experiment)	Salience	Fluency	Apprehension	Salience – fluency	Salience – apprehension
Liking (Experiment 1)	0.10 [0.08, 0.13]	0.03 [0.02, 0.05]	0.03 [0.02, 0.05]	0.07 [0.04, 0.09]	0.07 [0.04, 0.10]
Evaluative extremity (Experiment 1)	0.04 [0.03, 0.06]	0.00 [-0.002, 0.008]	-0.01 [-0.013, -0.003]	0.04 [0.03, 0.06]	0.05 [0.04, 0.07]
Emotional intensity (Experiment 1)	0.29 [0.25, 0.33]	0.01 [0.01, 0.03]	-0.02 [-0.03, -0.01]	0.28 [0.24, 0.32]	0.31 [0.27, 0.35]
Liking (Experiment 2)	0.03 [0.03, 0.04]	0.00 [0.0003, 0.0071]	0.00 [-0.007, 0.002]	0.03 [0.02, 0.04]	0.03 [0.03, 0.04]
Evaluative extremity (Experiment 2)	0.01 [0.01, 0.01]	0.00 [-0.0003, 0.0013]	0.00 [-0.0006, 0.0026]	0.01 [0.01, 0.01]	0.01 [0.01, 0.01]
Emotional intensity (Experiment 2)	0.09 [0.08, 0.11]	0.00 [-0.0001, 0.0032]	0.00 [-0.002, 0.007]	0.09 [0.08, 0.11]	0.09 [0.08, 0.11]
Liking (Experiment 4)	0.05 [0.02, 0.09]	0.02 [-0.00003, 0.03146]	0.02 [-0.00003, 0.03146]	0.04 [0.001, 0.074]	0.03 [0.02, 0.05]
Evaluative extremity (Experiment 4)	0.03 [0.01, 0.06]	0.005 [-0.0001, 0.0113]	-0.005 [-0.016, 0.004]	0.03 [0.01, 0.05]	0.04 [0.01, 0.06]
Emotional intensity (Experiment 4)	0.13 [0.05, 0.21]	0.02 [-0.0003, 0.0339]	-0.02 [-0.05, 0.01]	0.11 [0.03, 0.19]	0.15 [0.07, 0.23]

Note. The statistics in the first three columns are indirect effects (ab), and the last two columns provide the difference between two indirect effects (Preacher & Hayes, 2008). Preacher and Hayes (2008) multiple mediation bootstrapping procedure was used to estimate indirect effects, and comparison of indirect effects. Brackets provide 95% confidence interval (CI) of indirect effects. Statistics are rounded to two decimal places, except in cases where additional decimal places are needed to determine whether the 95% CI excludes zero.

exposure on apprehension, if anything, suppressed the effect of exposure on perceived emotional intensity. A comparison of indirect effects revealed that salience accounted for more of the effect of exposure on perceived emotional intensity than did fluency (difference: 0.28, 95% CI [0.24, 0.32]) and apprehension (difference: 0.31, 95% CI [0.27, 0.35]). This is consistent with the idea that salience accounts for more of this effect than fluency or apprehension.

For each dependent variable, we also compared the size of our hypothesized indirect effects to a reversed mediational path from exposure to the dependent variable to salience. The size of these reversed indirect effects were smaller than the indirect effects in the hypothesized direction (see Table S2 in online supplemental materials for details). On average, the indirect effect coefficient in the hypothesized direction was about 50% larger than the reversed path in Experiment 1 and twice as large in subsequent experiments. These results were consistent with our proposed mediational path, though it remains possible that liking, extremity, or emotional intensity lead to increased salience (e.g., if the relationship between liking and salience is bidirectional).

Discussion

Exposure made stimuli more salient and increased liking, evaluative extremity, and emotional intensity. In multiple mediation analyses, there was an indirect effect of exposure on liking, evaluative extremity, and perceived emotional intensity, through salience. This is consistent with the idea that salience may mediate these effects. For liking, there were also indirect effects through fluency and apprehension suggesting that salience, fluency, and apprehension may all partially account for the effect.

Experiment 2

We next sought to replicate and extend the effects of exposure on liking, evaluative extremity, and perceived emotional intensity. The procedure was similar to Experiment 1. We added an additional level of exposure (1 exposure) so that the exposure levels were equivalent to previous research (Wiggs, 1993; Zajonc et al., 1971).

We also tested whether a different manipulation to increase salience would produce similar effects as repeated exposure. In other research, we have found that sequential search for target objects increases the salience and visual distinctiveness of those objects (Mrkva et al., 2019). If the effects of repeated exposure on liking, evaluative extremity, and emotional intensity are because of increased salience, then other manipulations that increase salience without increasing exposure, such as this search manipulation, should similarly influence those outcomes. We hypothesized that both exposure and sequential search for targets would increase salience, liking, evaluative extremity, and emotional intensity. We expected that the effects of exposure and target search on salience would mediate the effects on liking, extremity, and emotional intensity.

Method

Participants. There were 109 American adults from MTurk who participated online in exchange for \$1.00. Four participants

dropped out of the study before viewing all three slideshows and were removed before analyses (resulting $N = 105$; 54 women, $M_{\text{age}} = 34.12$). Participants who were using a smartphone or tablet were prevented from advancing beyond the consent form.

Procedure. Participants completed a similar procedure as in Experiment 1. They were given the same cover story and completed the procedure of viewing a slideshow of stimuli and completing a series of ratings about each stimulus. They repeated this procedure for the same three sets of stimuli (Chinese characters, Turkish words, and segments of an abstract art painting) in three counterbalanced blocks.

Exposure was manipulated such that two stimuli were presented nine times, two were presented three times, two were presented one time, and two were not presented. All participants saw a total of 26 slides, with slide order randomly determined. Stimuli were presented for 1.0 s each time they appeared and a 1.0 s fixation cross was presented between stimuli.

In addition to manipulating exposure frequency, we included a manipulation to increase salience by increasing attention to some objects more than other objects (Mrkva et al., 2019). Participants were randomly assigned to one “target” stimulus in each slideshow. They were asked to press the “J key” on their keyboard each time the target stimulus appeared in the slideshow. Searching for targets increases salience and emotional intensity (Mrkva et al., 2019).

Following the slideshow, participants completed the same measures of liking, salience, fluency, and apprehension as in Experiment 1. We used a one-item measure of emotional intensity (“How intense was your emotional reaction to each image?” 1 = *not at all intense*, 9 = *extremely intense*).

At the end of the experiment, participants completed the recognition memory measure and reported whether they could understand any of the Turkish or Chinese words, as in Experiment 1. Participants also answered the same funnel debriefing questions. All participants were included in the primary analyses. No participants correctly guessed the research question and the significant effects reported below remained significant when excluding two participants who could understand at least one Chinese or Turkish word (see online supplemental materials).

Results

We analyzed data with linear mixed effects models with the fixed effects of exposure and target and random effects of participant and stimulus. The full model including contrast codes (linear, quadratic, and cubic) is provided in Appendix B.⁶

Salience. As predicted, participants indicated that stimuli they were exposed to more frequently were more salient than stimuli they were exposed to less frequently, $t(30.45) = 5.64$, $b = 0.44$, $p < .001$ (see Figure 2). Stimuli presented nine times were more salient ($M = 4.40$, $SD = 1.99$) than stimuli presented three times ($M = 3.68$, $SD = 1.88$), one time ($M = 3.36$, $SD = 1.79$), or zero

⁶Exposure was contrast-coded. The primary contrast that was hypothesized to influence each dependent measure was coded with 0 exposures = -1.5 , 1 exposure = -0.5 , 3 exposures = 0.5 , and 9 exposures = 1.5 . The other two contrasts were simply included to keep the model orthogonal (contrast 2: 0 exposures = 0.5 , 1 exposure = -0.5 , 3 exposures = -0.5 , 9 exposures = 0.5 ; contrast 3: 0 exposures = -0.5 , 1 exposure = 1.5 , 3 exposures = -1.5 , 9 exposures = 0.5).

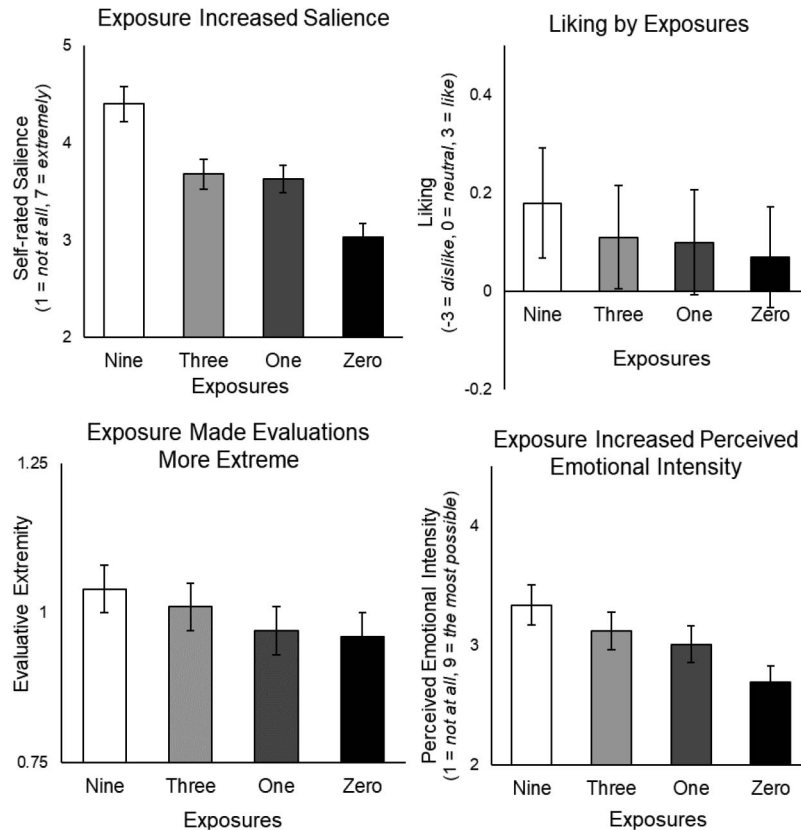


Figure 2. Effect of repeated exposure on salience, liking, evaluative extremity, and perceived emotional intensity in Experiment 2. Error bars depict ± 1 adjusted standard error, following Cousineau (2005).

times ($M = 3.03$, $SD = 1.81$). As predicted, target stimuli ($M = 4.62$, $SD = 2.11$) were more salient than nontarget stimuli ($M = 3.49$, $SD = 1.88$), $t(2357) = 11.42$, $b = 0.55$, $p < .001$.

Liking. There was no significant effect of exposure on liking ($M_9 \text{ exposures} = 0.18$, $SD = 1.27$; $M_3 \text{ exposures} = 0.11$, $SD = 1.22$; $M_1 \text{ exposure} = 0.10$, $SD = 1.21$; $M_0 \text{ exposures} = 0.07$, $SD = 1.21$), $t(35.36) = 1.17$, $b = 0.03$, $p = .250$. There was a target effect on liking: Target stimuli were liked more ($M = 0.69$, $SD = 1.15$) than nontarget stimuli ($M = 0.04$, $SD = 1.22$), $t(2398) = 9.58$, $b = 0.66$, $p < .001$.

Liking was weakly correlated with evaluative extremity, computed as in Experiment 1 ($b = -.01$, $p = .737$), and perceived emotional intensity ($b = .11$, $p < .001$). The effect of target on liking and nonsignificant effect of exposure on liking both remained similar when controlling for evaluative extremity and perceived emotional intensity (Target: $t(108.30) = 6.55$, $b = 0.57$, $p < .001$; Exposure: $t(141.20) = 0.55$, $b = 0.01$, $p = .582$).

Evaluative extremity. As in Experiment 1, we computed evaluative extremity as deviation from the neutral midpoint of the scale (Downing et al., 1992). Exposure increased evaluative extremity, $t(29.40) = 2.06$, $b = 0.03$, $p = .049$ (see Figure 2). Participants rated stimuli presented nine times further from the neutral midpoint ($M = 1.04$, $SD = 0.87$) compared with stimuli presented three times ($M = 1.01$, $SD = 0.83$), one time ($M = 0.97$, $SD = 0.84$), or zero times ($M = 0.96$, $SD = 0.84$). There was also an effect of Target on evaluative extremity ($M_{\text{target}} = 1.11$, $SD =$

0.84 ; $M_{\text{nontarget}} = 0.98$, $SD = 0.85$), $t(240.70) = 2.86$, $b = 0.12$, $p = .004$.

Evaluative extremity was correlated with perceived emotional intensity ($b = 0.07$, $p < .001$). The effects of Exposure and Target on evaluative extremity were not significant when controlling for liking and perceived emotional intensity (Exposure: $t(2107) = 0.94$, $b = 0.01$, $p = .349$; Target: $t(2421) = 1.26$, $b = 0.05$, $p = .208$).

Perceived emotional intensity. As predicted, exposure increased perceived emotional intensity, $t(31.24) = 4.79$, $b = 0.20$, $p < .001$ (see Figure 2). Participants reported more intense emotional reactions to stimuli following nine exposures ($M = 3.34$, $SD = 2.59$) compared with three exposures ($M = 3.12$, $SD = 2.44$), one exposure ($M = 3.01$, $SD = 2.43$), and zero exposures ($M = 2.69$, $SD = 2.24$). Also as predicted, target stimuli were perceived more emotionally intense ($M = 4.03$, $SD = 2.87$) than nontarget stimuli ($M = 2.92$, $SD = 2.35$), $t(2382.70) = 11.43$, $b = 1.15$, $p < .001$. The effects of Exposure and Target on perceived emotional intensity remained similar in size when controlling for evaluative extremity and liking (Exposure: $t(106.62) = 5.81$, $b = 0.19$, $p < .001$; Target: $t(2318.38) = 9.32$, $b = 0.89$, $p < .001$).

Mediation analyses: Exposure. Repeated exposure did not significantly influence apprehension ($M_9 \text{ exposures} = 1.84$, $SD = 1.37$; $M_3 \text{ exposures} = 1.77$, $SD = 1.26$; $M_1 \text{ exposure} = 1.83$, $SD = 1.24$; $M_0 \text{ exposures} = 1.75$, $SD = 1.23$), $t(22.30) = 0.95$, $b = 0.02$, $p = .354$, or fluency ($M_9 \text{ exposures} = 4.04$, $SD = 1.95$; $M_3 \text{ exposures} = 3.85$, $SD =$

1.91; M_1 exposure = 3.84, SD = 1.94; M_0 exposures = 3.85, SD = 1.93), $t(36.55) = 1.81$, $b = 0.06$, $p = .079$. The associations between salience, fluency, and apprehension were similar to Experiment 1 (salience and fluency: $b = 0.20$, $p < .001$; salience and apprehension: $b = 0.03$, $p = .336$; fluency and apprehension: $b = -0.21$, $p < .001$).

As in Experiment 1, we conducted multiple mediation analyses with 5,000 bootstrapped resamples to examine whether the effects of exposure on salience, fluency, and apprehension mediate the effects of exposure on evaluative extremity and perceived emotional intensity.

For liking, although there was not a significant direct effect of exposure, there was an indirect effect of exposure on liking through salience, $ab = 0.03$, 95% CI [0.03, 0.04] (Shrout & Bolger, 2002). There was also an indirect effect through fluency ($ab = 0.00$, 95% CI [0.0004, 0.0071]), but no indirect effect through apprehension ($ab = 0.00$, 95% CI [-0.007, 0.002]). A comparison of indirect effects indicated a larger effect through salience than through fluency (difference = 0.03, 95% CI [0.02, 0.04]) and apprehension (difference = 0.03, 95% CI [0.03, 0.04]).

For evaluative extremity, there was an indirect effect of exposure through salience, $ab = 0.01$, 95% CI [0.01, 0.01]. There was no significant indirect effect through fluency ($ab = 0.00$, 95% CI [-0.0003, 0.0013]) or apprehension ($ab = 0.00$, 95% CI [-0.001, 0.003]). The indirect effect through salience was larger than the indirect effects through fluency (difference = 0.01, 95% CI [0.01, 0.01]) and apprehension (difference = 0.01, 95% CI [0.01, 0.01]).

For perceived emotional intensity, there was an indirect effect of exposure through salience ($ab = 0.09$, 95% CI [0.08, 0.11]). There was no significant indirect effect through fluency ($ab = 0.00$, 95% CI [-0.0001, 0.0032]) or apprehension ($ab = 0.00$, 95% CI [-0.002, 0.007]). The indirect effect through salience was larger than the indirect effects through fluency (difference = 0.09, 95% CI [0.08, 0.11]) and apprehension (difference = 0.09, 95% CI [0.08, 0.11]).

Mediation analyses: Target. Target stimuli were more fluent than nontarget stimuli ($M_{\text{target}} = 4.25$, $SD = 1.94$; $M_{\text{nontarget}} = 3.85$, $SD = 1.93$), $t(2386) = 4.19$, $b = 0.42$, $p < .001$, and if anything elicited less apprehension than nontarget stimuli ($M_{\text{target}} = 1.71$, $SD = 1.21$; $M_{\text{nontarget}} = 1.81$, $SD = 1.29$), $t(2396) = -1.65$, $b = -0.10$, $p = .098$.

We tested whether the target effect was mediated by salience (and whether it was mediated by fluency and apprehension) using multiple mediation models. The same patterns emerged as for the mediation analyses of the exposure effect. For liking, there was an indirect effect of Target through salience ($ab = 0.14$, 95% CI [0.10, 0.18]) and through fluency ($ab = 0.05$, 95% CI [0.03, 0.08]), but no indirect effect through apprehension ($ab = 0.03$, 95% CI [-0.003, 0.058]; Appendix C). A comparison of indirect effects (Preacher & Hayes, 2008) revealed that the indirect effect through salience was larger than those through fluency (difference: 0.09, 95% CI [0.02, 0.14]) and apprehension (difference: 0.17, 95% CI [0.12, 0.22]).

For evaluative extremity, there was an indirect effect of target through salience ($ab = 0.05$, 95% CI [0.03, 0.07]), but no indirect effects through fluency or apprehension ($ab = 0.01$, 95% CI [-0.0004, 0.0160] and $ab = -0.01$, 95% CI [-0.022, 0.002], respectively). The indirect effect through salience was signifi-

cantly larger than the indirect effects through fluency (difference: 0.04, 95% CI [0.02, 0.07]) and apprehension (difference: 0.04, 95% CI [0.02, 0.06]).

For perceived emotional intensity, there was an indirect effect of target through salience ($ab = 0.43$, 95% CI [0.34, 0.52]), but no indirect effects through fluency or apprehension ($ab = 0.01$, 95% CI [-0.002, 0.034] and $ab = -0.03$, 95% CI [-0.063, 0.004], respectively). The indirect effect of target through salience was significantly larger than those through fluency (difference: 0.41, 95% CI [0.32, 0.50]) and apprehension (difference: 0.40, 95% CI [0.31, 0.49]). For each dependent variable, we also compared the hypothesized indirect effects to a reversed mediational path from exposure to the dependent variable to salience. The size of these reversed indirect effects were smaller than the hypothesized indirect effects (less than half the size on average; see Table S2 in online supplemental materials).

Discussion

These results replicated that exposure increased salience, evaluative extremity, and perceived emotional intensity. Unlike in Experiment 1, exposure did not significantly increase liking. This difference across experiments may be due either to random variation in effect size across experiments or to the presence of the additional task of searching for a target that could have diluted the exposure effect. Participants could have focused on the additional target task, making the differences in exposure less noticeable or salient than in Experiment 1.

We also found that the additional manipulation—directing attention in search of stimuli identified as targets—increased salience, extremity, perceived emotional intensity, and liking. Multiple mediation analyses were consistent with the hypothesis that the increased salience resulting from repeated exposure and searching for targets accounted for increased liking, evaluative extremity, and perceived emotional intensity. Even though exposure also increased fluency, the indirect effects through these mediators were smaller than through salience. The mediation analyses should be interpreted with some caution. Mediation analyses cannot directly demonstrate the causal impact of salience, and shared method variance could lead to overestimation of indirect effects (Fiedler, Harris, & Schott, 2018; Judd, Yzerbyt, & Muller, 2014). Additionally, it is possible that differences in reliability between the mediator items, or other differences between the salience, fluency, and apprehension items accounted for the mediation results in Experiments 1 and 2. In subsequent experiments, we use two items with more comparable wording to assess each construct and allow us to test the reliability of the mediator measures.

The fact that searching for target stimuli increased liking, extremity, and perceived emotional intensity is important because it is consistent with the idea that another method of experimentally increasing salience produces the same three effects as mere exposure. Though we suspect that the target manipulation increased liking because of salience, it also could have increased liking because searching for and finding a target might feel rewarding (Maunsell, 2004).

Whereas the effects in Experiments 1 and 2 could have been because of relative exposure or absolute exposure frequency, we test effects of relative exposure and absolute exposure indepen-

dently in the next two experiments. In Experiment 3, we examine effects of relative exposure for some participants and effects of absolute exposure for others.

Experiment 3

The possibility that mere exposure effects are because of increased salience implies that the effects of relative exposure should be larger than the effects of absolute exposure. In nearly all mere exposure experiments, including Experiments 1 and 2, absolute exposure is confounded with salience and relative exposure: High-exposure stimuli appear in the same presentation as low-exposure stimuli so that stimuli compete for salience.

In Experiment 3, we sought to isolate relative exposure from absolute exposure. We randomly assigned some participants to a within-participants relative exposure manipulation, as in Experiments 1 and 2. Other participants were randomly assigned to a between-participants absolute exposure manipulation. In the between-participants conditions, all stimuli in a slideshow were presented the same number of times, with stimuli presented more frequently in some conditions than in other conditions. In the within-participants condition, some stimuli were presented nine times, others three times, others one time, and still others were not presented.⁷ Based on the idea that relative (rather than absolute) exposure accounts for the effects in Experiments 1 and 2, we predicted that the effects of within-subjects (relative) exposure on liking, evaluative extremity, and perceived emotional intensity would be larger than the effects of between-subjects (absolute) exposure. In other words, we predicted that in the within-participants condition, stimuli presented nine times would be liked more, rated more extreme, and rated more emotionally intense than stimuli presented one time, whereas these differences between stimuli presented nine times compared with one time in the between-participants conditions would be significantly smaller.

Method

Participants. There were 423 American adults from MTurk who participated online in exchange for \$1.00. Twenty-three dropped out of the study before viewing all three slideshows and were excluded before analyses (resulting $N = 400$; 223 women, $M_{\text{age}} = 36.27$).⁸ Participants who had completed Experiment 1 or Experiment 2, and participants who were using a smartphone or tablet were excluded from eligibility.

Procedure. Participants were randomly assigned to one of four conditions. In one condition, exposure was manipulated within-participants similar to Experiment 2. Two stimuli in each slideshow were presented nine times, two were presented three times, two were presented one time, and two were not presented. The other three conditions manipulated exposure between-participants. Participants in each of these conditions viewed two stimuli per slideshow. We manipulated the number of times these two stimuli appeared. One group of participants viewed two stimuli nine times each, another group three times each, and a third group one time each. Note that the key comparisons were between stimuli presented one, three, and nine times, because stimuli presented zero times were low in relative and absolute exposure for all participants. In contrast, stimuli presented one time were low relative exposure among those in the within-participants condition

but high relative exposure among those in the between-participants condition.

Participants were given the same cover story as in Experiments 1 and 2. They completed the following procedure with three sets of counterbalanced stimuli: Chinese characters, Turkish words, and segments of an abstract art painting. In each block, participants viewed a presentation containing the stimuli described above; stimuli appeared for 1.0 s each time they were presented with a 1.0 s fixation cross between stimuli.

Following this slideshow, participants rated eight stimuli from the set, including all stimuli presented in the slideshow and novel stimuli from the same set. They completed the same measures as in Experiment 1. Participants then completed the same measure of recognition memory and the same funnel debriefing procedure as in Experiments 1 and 2. The significant effects reported below remained significant when excluding the 13 participants who correctly guessed the research question and when excluding the six participants who could understand either the Chinese or Turkish words.

Results

To test the hypotheses that relative exposure would influence liking, salience, evaluative extremity, and emotional intensity more than absolute exposure, we used linear mixed effects models with participant and stimulus as random effects, as in Experiments 1 and 2. We followed a procedure for testing the difference between a within-participants effect and a between-participants effect within the context of mixed effects models (Yzerbyt & Judd, 2019).⁹

Salience. As predicted, exposure influenced salience more in the within-participants condition than in the between-participants condition, $t(346.76) = 5.40$, $b = 0.60$, $p < .001$ (see Figure 3). The effect of repeated exposure on salience was large in the within-participants condition: Participants in this condition rated stimuli presented nine times as more salient ($M = 4.22$, $SD = 1.98$) than stimuli presented three times ($M = 3.79$, $SD = 1.90$) or one time ($M = 3.13$, $SD = 1.80$), $t(96.48) = 9.92$, $b = 0.74$, $p < .001$. In the between-participants conditions, there was no signif-

⁷ Across all conditions, there were some stimuli that were rated but not presented in the slideshow. Stimulus presentation was heterogeneous for all participants in Experiments 3 and 4, meaning that they saw more than one stimulus in the same slideshow. In Experiment 3, participants in the between-persons conditions viewed two stimuli in each slideshow; both presented the same number of times. In Experiment 4, participants viewed six stimuli in each slideshow.

⁸ Four were excluded from the within-participants condition, nine from the one exposure condition, six from the three exposures condition, and four from the nine exposures condition.

⁹ As a robustness check, we also conducted hybrid t tests (Hsee, 1996); all of the significant effects remained significant when using hybrid t tests. For the reasons described in the main text, the key contrast codes compared stimuli presented one, three, and nine times, using contrast codes similar to Experiment 1 (1 = nine exposures, 0 = three exposures, -1 = one exposure), and the other contrast, which was included simply to keep the model orthogonal (three exposures = $2/3$; one and nine exposures = $-1/3$). We also included in the model the effect of within versus between design (coded $1/2$ if within participants and $-1/2$ if between) and a predictor indicating whether the stimulus was not presented (1 = not presented; 0 = presented). The comparison of within-participants to between-participants effects was the Exposure $\times$ Within versus Between Contrast interaction.

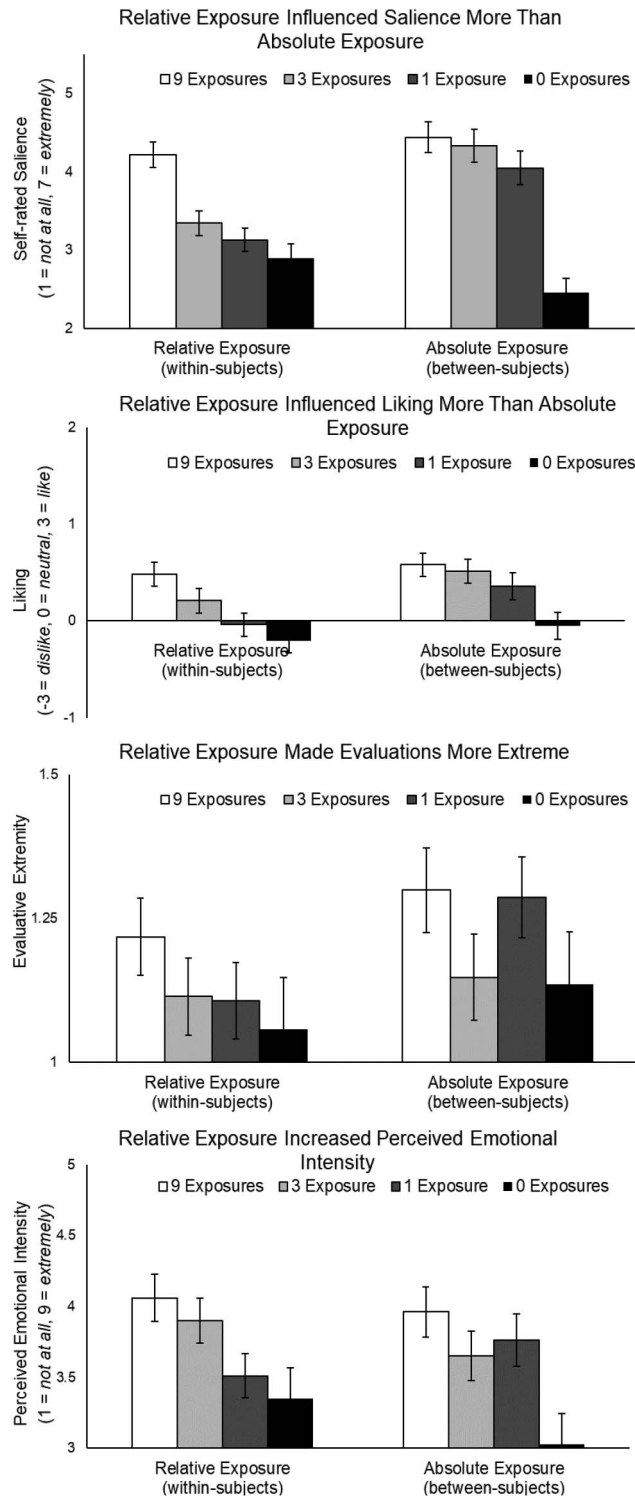


Figure 3. Effect of relative compared with absolute exposure on salience (top panel), liking (second panel), evaluative extremity (third panel), and perceived emotional intensity (bottom panel) in Experiment 3. Error bars are adjusted standard errors (Cousineau, 2005).

icant effect on salience ($M_9 \text{ exposures} = 4.44$, $SD = 1.97$; $M_3 \text{ exposures} = 4.33$, $SD = 2.04$; $M_1 \text{ exposure} = 4.05$, $SD = 2.09$), $t(271.99) = 1.32$, $b = 0.13$, $p = .188$. Relative exposure influenced salience more than absolute exposure. As expected, stimuli were salient in the between-participants conditions even if they were presented only one or three times, likely because there were no other stimuli in the slideshow competing for salience and attention. For salience and all subsequent outcome measures, stimuli not presented in the slideshow were rated significantly lower than stimuli presented in the slideshows (see Figure 3 and online supplemental materials).

Liking. Overall, exposure increased how much participants liked stimuli, $t(90.44) = 5.30$, $b = 0.20$, $p < .001$. As predicted, this effect of exposure was larger in the within-participants condition than the between-participants conditions, $t(952.69) = 2.17$, $b = 0.13$, $p = .030$ (see Figure 3). Simple effects tests indicated there was a larger effect of exposure on liking in the within-participants condition ($M_9 \text{ exposures} = 0.48$, $SD = 1.36$; $M_3 \text{ exposures} = 0.21$, $SD = 1.38$; $M_1 \text{ exposure} = -0.04$, $SD = 1.30$), $t(8760.66) = 7.67$, $b = 0.26$, $p < .001$, than in the between-participants condition ($M_9 \text{ exposures} = 0.58$, $SD = 1.37$; $M_3 \text{ exposures} = 0.51$, $SD = 1.36$; $M_1 \text{ exposure} = 0.36$, $SD = 1.46$), $t(456.59) = 2.55$, $b = 0.13$, $p = .011$.

Liking was positively associated with emotional intensity ($b = 0.16$, $p < .001$), but not with evaluative extremity ($b = -0.03$, $p = .117$). When controlling for emotional intensity and evaluative extremity, the effect of relative exposure on liking remained similar, $t(8771.57) = 6.72$, $b = 0.23$, $p < .001$, as did the larger effect of relative exposure compared with absolute exposure, $t(1031.84) = 1.98$, $b = 0.11$, $p = .048$.

Evaluative extremity. Consistent with expectation, simple-effects tests revealed that exposure increased evaluative extremity in the within-participants condition ($M_9 \text{ exposures} = 1.22$, $SD = 0.90$; $M_3 \text{ exposures} = 1.17$, $SD = 0.90$; $M_1 \text{ exposure} = 1.11$, $SD = 0.85$), $t(81.87) = 2.47$, $b = 0.06$, $p = .016$, replicating Experiments 1 and 2. Exposure did not significantly increase extremity in the between-participants conditions ($M_9 \text{ exposures} = 1.30$, $SD = 0.92$; $M_3 \text{ exposures} = 1.25$, $SD = 0.89$; $M_1 \text{ exposure} = 1.29$, $SD = 0.92$), $t(213.24) = 0.79$, $b = 0.02$, $p = .432$. However, the direct comparison of the within-participant and between-participants effects was not significant, $t(556.38) = 1.06$, $b = 0.04$, $p = .291$. Evaluative extremity was positively associated with emotional intensity ($b = 0.08$, $p < .001$). When controlling for liking and emotional intensity, the effect of relative exposure on evaluative extremity was reduced slightly and not significant, $t(72.70) = 1.71$, $b = 0.04$, $p = .093$.

Perceived emotional intensity. Exposure increased perceived emotional intensity in the within-participants condition ($M_9 \text{ exposures} = 4.06$, $SD = 2.43$; $M_3 \text{ exposures} = 3.90$, $SD = 2.43$; $M_1 \text{ exposure} = 3.51$, $SD = 2.22$), $t(111.52) = 5.53$, $b = 0.34$, $p < .001$, replicating Experiments 1–2, but not the between-participants conditions ($M_9 \text{ exposures} = 3.96$, $SD = 2.49$; $M_3 \text{ exposures} = 3.65$, $SD = 2.43$; $M_1 \text{ exposure} = 3.76$, $SD = 2.41$), $t(324.79) = 1.46$, $b = 0.12$, $p = .144$. The effect of relative exposure on emotional intensity was significantly larger than the effect of absolute exposure on emotional intensity, $t(406.56) = 2.17$, $b = 0.21$, $p = .031$. When controlling for evaluative extremity and liking, the effect of relative exposure on emotional intensity remained similar, $t(108.55) = 4.55$, $b = 0.26$, $p < .001$, and the interaction between relative and absolute exposure was

reduced slightly and nonsignificant, $t(407.13) = 1.76$, $b = 0.16$, $p = .080$.

Mediation analyses. We used the same mediation analysis procedure as in Experiments 1–2. The models were consistent with our hypothesis that the effects of relative exposure on liking, evaluative extremity, and perceived emotional intensity would be mediated by salience. The associations between salience, apprehension, and fluency were similar to Experiment 1 (salience and fluency: $b = 0.16$, $p < .001$; salience and apprehension: $b = 0.02$, $p = .125$; fluency and apprehension: $b = -0.15$, $p < .001$).

For liking, there was an indirect effect of relative exposure on liking through salience ($ab = 0.10$, 95% CI [0.08, 0.13]). There were also indirect effects through fluency ($ab = 0.04$, 95% CI [0.02, 0.06]), and apprehension ($ab = 0.01$, 95% CI [0.001, 0.029]). A comparison of indirect effects indicated a larger effect through salience than through fluency (difference = 0.06, 95% CI [0.04, 0.09]) and apprehension (difference = 0.08, 95% CI [0.05, 0.11]).

For evaluative extremity, there was an indirect effect of relative exposure through salience ($ab = 0.04$, 95% CI [0.03, 0.05]). There were no indirect effects through fluency ($ab = 0.00$, 95% CI [-0.001, 0.007]) and the apprehension indirect effect was not in the direction that apprehension accounts predict ($ab = 0.00$, 95% CI [-0.0076, -0.0002]). The indirect effect through salience was larger than the indirect effects through fluency (difference 0.04, 95% CI [0.03, 0.05]) and apprehension (difference = 0.04, 95% CI [0.03, 0.05]).

For perceived emotional intensity, there was an indirect effect of relative exposure through salience ($ab = 0.27$, 95% CI [0.22, 0.32]). There were also smaller indirect effects through fluency ($ab = 0.01$, 95% CI [0.003, 0.022]) and apprehension ($ab = -0.01$, 95% CI [-0.017, -0.001]). The indirect effect through salience was significantly larger than the indirect effects through fluency (difference = 0.26, 95% CI [0.21, 0.31]) and apprehension (difference = 0.26, 95% CI [0.21, 0.31]). We also conducted analogous mediation analyses among those in the between-participants conditions that revealed substantially smaller indirect effects through salience than for the relative exposure (within-participants) condition (online supplemental materials).

Discussion

Relative exposure (within participants) increased liking, salience, evaluative extremity, and perceived emotional intensity, replicating previous experiments, whereas absolute exposure (between participants) did not significantly influence salience, evaluative extremity, or perceived emotional intensity. The effect of relative exposure was significantly larger than the effect of absolute exposure for salience, liking, and perceived emotional intensity. The difference was in the predicted direction but was not significant for evaluative extremity. It is noteworthy that though relative exposure increased liking more than absolute exposure, absolute exposure still had a significant effect on liking. This suggests that relative and absolute exposure might both increase liking, though the former effect was larger than the latter.

The finding that within-subjects (relative) exposure influences liking more than between-subjects exposure does not rule out fluency explanations, because judgments of fluency are likely impacted by relative comparisons more than absolute levels (Han-

sen, Dechene, & Wänke, 2008; Hansen & Wänke, 2008; Wänke & Hansen, 2015). Though smaller than the indirect effect through salience, there was an indirect effect on liking through fluency, consistent with the possibility that salience and fluency both partially account for exposure effects on liking.

Experiment 4

In Experiment 4, we had two primary objectives. First, we tested the hypothesis derived from our salience account that relative exposure should increase liking, evaluative extremity, and emotional intensity even when controlling for absolute exposure. As discussed earlier, stimuli presented nine times might be salient when other stimuli in the surroundings are presented fewer times, but nonsalient when other stimuli are presented many more times (see Table 1). If salience and relative exposure account for exposure effects, relative exposure should increase liking and evaluative extremity even when holding absolute exposure frequency constant.

Additionally, we sought to generalize the finding that relative exposure increases evaluative extremity to contexts with positively valenced stimuli and negatively valenced stimuli. Our account of exposure effects implies that relative exposure increases both liking and evaluative extremity and that these effects are at least partly independent of one another. The finding in Experiment 1 that the liking and extremity effects remained when controlling for the other variable were consistent with this idea that they are partly independent. This account also implies that exposure should increase liking for positive stimuli more than negative stimuli, because effects on liking and extremity would both increase liking for positive stimuli but would counteract one another for negative stimuli. For positive stimuli, evaluative extremity and liking would operate in the same direction both increasing liking, whereas for negative stimuli they would operate in different directions producing either no effect or a small effect. (If the extremity effect is larger than the liking effect, negative stimuli might decrease in liking somewhat, and if the liking effect is stronger, negative stimuli might be liked somewhat more at higher levels of exposure. In any case, the liking effect for negative stimuli should be smaller than for positive stimuli.) We tested this hypothesis that stimulus valence would moderate the relationship between relative exposure and liking by presenting words with positive meanings to some participants and words with negative meanings to other participants, unlike Experiments 1–3 that used only neutral words. Using positive and negative stimuli and using some common English words also allows us to test whether the effects of relative exposure generalize to familiar as well as positive and negative stimuli that people encounter in everyday life.

Method

Participants. There were 200 American adults who were recruited from MTurk. They participated online in exchange for \$1.75. Eight participants dropped out of the study before viewing all three slideshows and were removed before analyses (resulting $N = 192$; 101 men, $M_{\text{age}} = 37.19$). Participants using a smartphone or tablet were prevented from advancing past the consent form.

Procedure. The experiment began with a cover story, in which participants were told that we were examining how features

of letters and words (e.g., sharp edges and acute angles) influence how memorable they are. We used a different cover story than in past experiments to ensure that the effects would generalize even with a cover story that does not call attention to exposure frequency.

Participants were randomly assigned to either a “nine most” or “nine least” exposure condition. Among participants in the “nine most” condition, two stimuli were presented nine times, two were presented three times, and two were presented one time. Among participants in the “nine least” condition, two stimuli were presented nine times, two were presented 18 times, and two were presented 27 times. This was intended to manipulate relative exposure while varying absolute exposure, allowing us to examine whether relative exposure increases liking even after adjusting for absolute exposure. According to a recent meta-analysis, exposure typically increases liking up until approximately 60 exposures in experiments like this (Montoya et al., 2017; though this likely depends on the design and stimuli, Harrison, 1977), meaning that exposure should increase liking in both conditions of this experiment. Two stimulus sets were the same as in previous experiments (Chinese characters and Turkish words), while the third consisted of English words. We added the English words to examine whether the effects of relative exposure generalize to familiar stimuli that participants regularly encounter.

We manipulated stimulus valence by randomly assigning participants to either a positive valence or negative valence condition. Participants in the positive valence condition were told that the Turkish and Chinese words had positive meanings (Sherman & Kim, 2002): “These eight words all have positive meanings, though some have extremely positive meanings and others are more mildly positive (less extreme). For example, one means ‘excellent’ and another means ‘good.’” Instructions for the negative valence condition informed participants that the eight words have negative meanings, to varying degrees. Valence was manipulated for English words simply by using words with positive meanings (e.g., enjoyment, triumph) or negative meanings (e.g., pain, bankrupt).

Participants viewed a slideshow containing six stimuli at three levels of exposure. Then, they completed a series of dependent measures for the six stimuli. Specifically, they completed measures of liking, emotional intensity, and evaluative strength, in random order. Then, they completed measures of the three potential mediators—salience, fluency, and apprehension—in random order. Unlike in previous experiments, we randomized the order of these mediator measures, used two items for each mediator, and made changes to the item wording, to address the possibility that differences in order, measure reliability, or wording (the part of the wording that was unrelated to the constructs themselves) accounted for the mediation results in Experiments 1 and 2. Specifically, the two salience items assessed “To what extent does each word seem to stand out to you?” and “As the words were presented in the slideshow, how salient was each word?” The two fluency items assessed “To what extent does each word seem easy-to-process to you?” and “As the words were presented in the slideshow, how easy-to-process was each word?” The two apprehension items assessed “To what extent does each word make you feel uneasy?” and “As the words were presented in the slideshow, how uneasy did you feel about each word?” The two items assessing each construct had large positive associations with one another

(salience: $b = 0.76$, $p < .001$; fluency: $b = 0.84$, $p < .001$; apprehension: $b = 0.85$, $p < .001$).

After completing these measures for each stimulus in the first slideshow, participants repeated this procedure of viewing the slideshow and rating stimuli for the two remaining stimulus sets (order counterbalanced). Participants only rated the six stimuli presented in a slideshow (rather than rate two additional nonpresented stimuli) to isolate effects of exposure frequency from the presence or absence of prior exposure.

Finally, participants selected what they thought we were studying from eight multiple-choice options, answered why they thought some stimuli were presented more frequently than others, reported whether they could understand the Mandarin characters or Turkish words, and reported their ethnicity, gender, and age.

They answered a one-item assessment of holistic thinking (Choi, Koo, & Choi, 2007) in which they rated agreement with the statement “The whole, rather than its parts, should be considered in order to understand a phenomenon” (1 = *strongly disagree*, 7 = *strongly agree*). Though we did not predict that holistic thinking would moderate the exposure effects, it is possible that people who process things holistically would be differentially sensitive to effects of salience and relative exposure. Participants also completed the same funnel debriefing procedure as in previous experiments and completed a question asking them how they interpreted the words “salient” and “stand out” (see Appendix A). The significant effects reported below remained significant when excluding the five participants who correctly guessed the research question from the eight multiple-choice options or when excluding the eight participants who could understand at least one of the Chinese characters or Turkish words, or when excluding those who interpreted salience to mean exposure, fluency, or another unintended interpretation (see online supplemental materials).

Stimuli. We used words that had been previously normed (Affective Norms for English Words; Bradley & Lang, 1999). We chose positive and negative sets that were approximately equivalent along normed ratings of arousal ($M_{\text{positive}} = 5.59$, $SD = 0.54$; $M_{\text{negative}} = 5.61$, $SD = 0.75$) and valence extremity ($M_{\text{positive}} = 2.13$, $SD = 0.06$; $M_{\text{negative}} = 2.14$, $SD = 0.16$), though words in the positive set were near the high end of the valence scale ($M_{\text{valence}} = 7.86$, $SD = 0.06$; words: merry, liberty, triumph, adorable, waterfall, sunrise, birthday, and enjoyment) and words in the negative set were near the low end ($M_{\text{valence}} = 2.13$, $SD = 0.16$; negative words: upset, bankrupt, despise, lonely, useless, vomit, pain, and shamed).

Results

For each dependent variable, we computed linear mixed effects models with participant and stimulus as random effects, and with relative exposure, absolute exposure, and their quadratic terms as fixed effects. Relative exposure was contrast-coded to compare stimuli at the highest level of relative exposure to stimuli at the lowest level of relative exposure. For participants in the “nine most” condition, the nine exposure stimuli were highest relative exposure and 1 exposure stimuli were lowest (contrast-coded, nine exposures = 1, three exposures = 0, one exposure = -1). For participants in the “nine least” condition, the 27 exposure stimuli were highest relative exposure and nine exposure stimuli were lowest (contrast-coded, 27 exposures = 1, 18 exposures = 0,

nine exposures = -1) Additionally, absolute exposure was the absolute number of times the stimulus was presented in the slide-show, quadratic absolute exposure was absolute exposure squared, and a quadratic relative exposure term (low and high relative exposure coded $\frac{1}{3}$; moderate relative exposure coded $-\frac{2}{3}$) was included to keep the relative exposure contrasts in the model orthogonal.

Salience. Consistent with our predictions, relative exposure increased salience. Stimuli presented at the highest level of relative exposure were rated more salient than those presented at the moderate and low relative exposure levels ($M_{\text{high relative exposure}} = 3.28$, $SD = 1.25$; $M_{\text{moderate relative exposure}} = 3.11$, $SD = 1.23$; $M_{\text{low relative exposure}} = 2.93$, $SD = 1.24$), $t(201.70) = 3.16$, $b = 0.15$, $p = .002$. There was no effect of linear absolute exposure on self-rated salience or an effect of quadratic absolute exposure (both $|t|s < 1$, $ps > .25$).

Liking. As predicted, relative exposure increased liking. Stimuli at the highest level of relative exposure were liked more than those at the moderate and low relative exposure levels, ($M_{\text{high relative exposure}} = 0.22$, $SD = 1.77$; $M_{\text{moderate relative exposure}} = 0.19$, $SD = 1.72$; $M_{\text{low relative exposure}} = 0.05$, $SD = 1.71$), $t(481.00) = 3.04$, $b = 0.20$, $p = .003$ (see Figure 4). There was neither a linear nor quadratic effect of absolute exposure on liking (both $|t|s < 1$, $ps > .25$).

Liking was weakly associated with emotional intensity ($b = 0.07$, $p < .001$), evaluative extremity ($b = 0.01$, $p = .608$), and evaluative strength ($b = 0.11$, $p = .017$). The effect of relative exposure on liking remained significant when controlling for emotional intensity, evaluative extremity, and evaluative strength, $t(475.30) = 2.51$, $b = 0.16$, $p = .012$, suggesting that the liking effect is at least partly independent of the other effects of relative exposure.

Evaluative extremity and strength. Relative exposure did not significantly increase how distant evaluations were from the midpoint of the liking scale ($M_{\text{high relative exposure}} = 1.43$, $SD = 1.07$; $M_{\text{moderate relative exposure}} = 1.35$, $SD = 1.07$; $M_{\text{low relative exposure}} = 1.33$, $SD = 1.07$), $t(479.90) = 1.13$, $b = 0.04$, $p = .259$. However, relative exposure did increase the strength of participants' evaluations ($M_{\text{high relative exposure}} = 5.11$, $SD = 2.57$; $M_{\text{moderate relative exposure}} = 4.90$, $SD = 2.53$; $M_{\text{low relative exposure}} = 4.58$, $SD = 2.53$), $t(515.40) = 2.21$, $b = 0.22$, $p = .028$. There were no effects of linear or quadratic absolute exposure on evaluative extremity or strength (all $|t|s < 1$, $ps > .25$).

Evaluative extremity and evaluative strength were each positively associated with emotional intensity (respectively, $b = 0.14$, $p < .001$ and $b = 0.63$, $p < .001$). Unlike in Experiments 1 and 2, the effects of relative exposure on evaluative strength and extremity were not significant after controlling for liking and emotional intensity (both $|t|s < 1$, $ps > .25$).

Perceived emotional intensity. Relative exposure also increased emotional intensity. Participants rated high relative exposure stimuli as more emotionally intense than moderate and low relative exposure stimuli ($M_{\text{high relative exposure}} = 4.89$, $SD = 2.58$; $M_{\text{moderate relative exposure}} = 4.66$, $SD = 2.60$; $M_{\text{low relative exposure}} = 4.34$, $SD = 2.55$), $t(563.30) = 2.56$, $b = 0.26$, $p = .011$. There was neither a linear nor quadratic effect of absolute exposure on emotional intensity (both $|t|s < 1.5$, $ps > .15$). The effect of relative exposure on emotional intensity was somewhat smaller

after controlling for liking, evaluative extremity, and evaluative strength, $t(451.30) = 1.70$, $b = 0.11$, $p = .089$.

Mediation analyses. Relative exposure did not significantly influence apprehension ($M_{\text{high relative exposure}} = 2.33$, $SD = 1.35$; $M_{\text{moderate relative exposure}} = 2.33$, $SD = 1.34$; $M_{\text{low relative exposure}} = 2.30$, $SD = 1.31$), $t(587.60) = -1.16$, $b = -0.06$, $p = .249$. It did nonsignificantly increase fluency ($M_{\text{high relative exposure}} = 3.50$, $SD = 1.34$; $M_{\text{moderate relative exposure}} = 3.33$, $SD = 1.36$; $M_{\text{low relative exposure}} = 3.30$, $SD = 1.40$), $t(476.30) = 1.89$, $b = 0.08$, $p = .060$. Salience was positively associated with apprehension ($b = 0.25$, $p < .001$) and fluency ($b = 0.27$, $p < .001$), whereas apprehension and fluency were negatively associated ($b = -0.05$, $p = .005$).

As in previous experiments, we conducted parallel multiple mediation models to examine whether the effects of exposure on salience, fluency, and apprehension mediate the effects of exposure on liking, evaluative extremity, and perceived emotional intensity. As predicted, there was an indirect effect of relative exposure through salience for all dependent variables. In contrast, there were no significant indirect effects of relative exposure through fluency for any of the dependent variables. Specifically, for liking there was an indirect effect of exposure through salience ($ab = 0.05$, 95% CI [0.02, 0.09]) but no significant indirect effect through fluency ($ab = 0.02$, 95% CI [-0.00003, 0.03146]) or apprehension ($ab = 0.03$, 95% CI [-0.02, 0.09]). A comparison of mediational paths (Preacher & Hayes, 2008) indicated that the indirect effect through salience was significantly larger than the indirect effects through fluency (difference = 0.04, 95% CI [0.001, 0.074]) and apprehension ($ab = 0.03$, 95% CI [0.01, 0.04]).

Similarly, there was a large indirect effect of exposure through salience on evaluative extremity ($ab = 0.03$, 95% CI [0.01, 0.06]), but no significant indirect effects through fluency ($ab = 0.005$, 95% CI [-0.0001, 0.0113]) or apprehension ($ab = -0.01$, 95% CI [-0.016, 0.004]). A comparison of mediational paths revealed that the effect through salience was significantly larger than the indirect effects through fluency (difference = 0.03, 95% CI [0.007, 0.051]) and apprehension (difference = 0.04, 95% CI [0.01, 0.06]).

There was also an indirect effect of exposure on evaluative strength through salience ($ab = 0.13$, 95% CI [0.05, 0.21]) but no indirect effects through fluency ($ab = 0.02$, 95% CI [-0.0003, 0.0339]) or apprehension ($ab = -0.02$, 95% CI [-0.04, 0.01]). The indirect effect through salience was significantly larger than the other two paths (salience—fluency difference = 0.11, 95% CI [0.02, 0.19] for fluency; salience—apprehension difference = 0.15, 95% CI [0.07, 0.24]).

For emotional intensity, there was an indirect effect of exposure through salience, consistent with our hypothesis ($ab = 0.13$, 95% CI [0.05, 0.21]). In contrast, there were no indirect effects through fluency ($ab = 0.02$, 95% CI [-0.0003, 0.0339]) or apprehension ($ab = -0.02$, 95% CI [-0.05, 0.01]). The indirect effect through salience was significantly larger than the other two paths (salience—fluency difference = 0.11, 95% CI [0.03, 0.19]; salience—apprehension difference = 0.15, 95% CI [0.07, 0.23]).

For each dependent variable, we also examined the reversed mediational path from exposure to each dependent variable to salience. The size of these reversed indirect effects were smaller than the hypothesized indirect effects from exposure to salience to

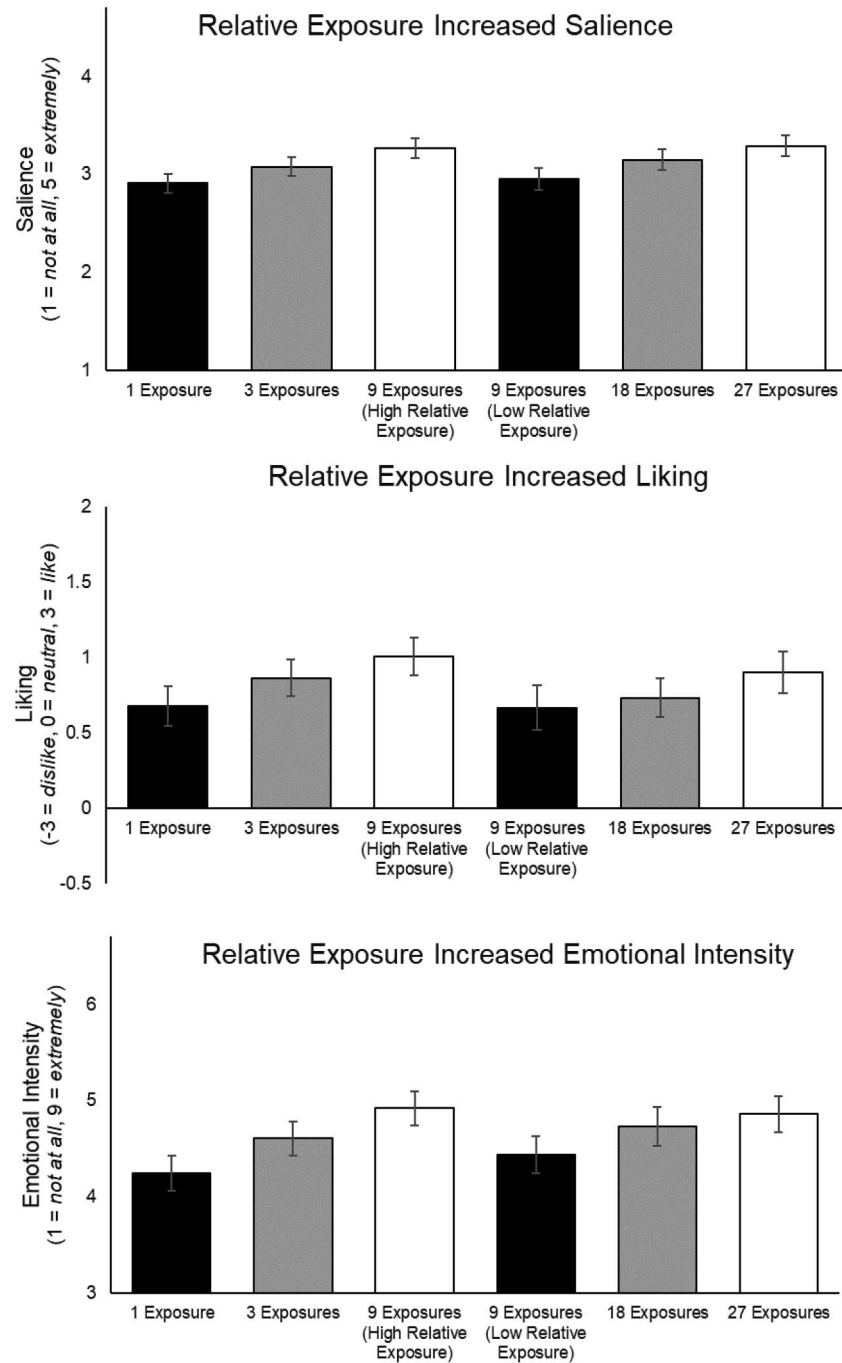


Figure 4. Effect of relative compared with absolute exposure on evaluations in Experiment 4. Whereas the salience, extremity, and intensity panels portray all stimuli, the liking panel portrays means for positive stimuli only (as expected, negative stimuli did not increase in liking with exposure). Error bars are adjusted standard errors (Cousineau, 2005).

the dependent variables (Table S2 in online supplemental materials).

Moderation by stimulus valence. We also tested the hypothesis, derived from a salience account of exposure effects, that valence should moderate the relationship between relative exposure and liking. Because we hypothesized that relative exposure increases evaluative extremity and

liking, it is clear that positive stimuli should be liked more as a function of relative exposure. For negative stimuli, however, the two hypothesized effects of exposure (i.e., increased extremity and increased liking) work in opposite directions—extremity would make evaluations of negative stimuli more negative and increased liking would make evaluations more positive.

Consistent with this prediction, there was a significant Relative Exposure $\times$ Stimulus Valence interaction, $t(3230) = 2.08$, $b = 0.12$, $p = .037$. Simple-effects tests indicated that relative exposure greatly increased liking for positive stimuli ($M_{\text{high relative exposure}} = 0.96$, $SD = 1.45$; $M_{\text{moderate relative exposure}} = 0.81$, $SD = 1.41$; $M_{\text{low relative exposure}} = 0.67$, $SD = 1.45$), $t(3228) = 3.57$, $b = 0.14$, $p < .001$. In contrast, relative exposure did not significantly influence liking for negative stimuli ($M_{\text{high relative exposure}} = -0.57$, $SD = 1.74$; $M_{\text{moderate relative exposure}} = -0.47$, $SD = 1.77$; $M_{\text{low relative exposure}} = -0.60$, $SD = 1.72$), $t(3228.29) = 0.33$, $b = 0.01$, $p = .745$. This is consistent with the idea that exposure has two simultaneous effects, one on increased liking and one on evaluative extremity. There was also a main effect of stimulus valence on liking ($M_{\text{positive}} = 0.82$, $SD = 1.44$; $M_{\text{negative}} = -0.55$, $SD = 1.74$), $t(189.80) = 11.32$, $b = 1.35$, $p < .001$ and a main effect of relative exposure, $t(476.80) = 2.60$, $b = 0.15$, $p = .010$. Among negative stimuli, salience predicted higher evaluative extremity, $t(1622.31) = 11.38$, $b = 0.23$, $p < .001$, and marginally higher liking, $t(1666.13) = 1.70$, $b = 0.06$, $p = .090$. This latter relationship increased further when controlling for evaluative extremity, $t(1664.43) = 4.54$, $b = 0.15$, $p < .001$, suggesting that extremity may suppress an effect of salience on increased liking for negative stimuli.

Discussion

As predicted, relative exposure increased liking, evaluative extremity, and emotional intensity even when controlling for absolute exposure. In contrast, linear and quadratic absolute exposure did not influence any of these variables after controlling for relative exposure. The results of Experiment 4 also suggest that the effects of relative exposure on liking are moderated by stimulus valence. That is, relative exposure increases liking of positive stimuli more than negative stimuli.

The result that relative exposure influences evaluations even when controlling for absolute exposure does not rule out fluency explanations, because judgments of fluency are shaped by relative comparisons and discrepancies from expectations (Hansen et al., 2008; Hansen & Wänke, 2008; Wänke & Hansen, 2015). The mediation analyses also supported our hypothesis that salience would account for exposure effects, and there were indirect effects on liking through fluency, though the indirect effects through salience were larger. These results are consistent with the possibility that salience and fluency both partially account for exposure effects on liking.

Experiment 5

In Experiment 5, we sought to directly manipulate salience without affecting exposure by making one stimulus stand out within a scene containing many stimuli presented for the same amount of time. In a causal chain approach to experimental design (Spencer et al., 2005), this tests whether salience (the proposed mediator) directly increases liking, evaluative extremity, and perceived emotional intensity. Experiments 1–2 suggest that repeated exposure increases salience, so if salience increases liking, it would provide evidence for the proposed path from repeated exposure to salience to increased liking.

Salience is shaped in part by whether a stimulus is different in color, orientation, or other features relative to other competing

objects in its immediate surroundings (Bundesen & Pedersen, 1983; Green & Anderson, 1956; Itti et al., 1998; Nothdurft, 1991). For example, when one red apple is surrounded by several yellow apples or one yellow apple is surrounded by several red apples, the color singleton is salient whether it is red or yellow (Green & Anderson, 1956; Itti et al., 1998). To manipulate salience, we made one stimulus light gray while the other eight stimuli in a scene were dark gray or made one stimulus dark gray while the other eight stimuli in the scene were light gray.

We also crossed the salience manipulation with a common manipulation of stimulus fluency (Mrkva et al., 2018; Reber et al., 1998; Reber, Zimmermann, & Wurtz, 2004) that is designed to make some stimuli more readable than others. Though our results in the previous experiments suggested that fluency did not account for the effects of relative exposure and salience, crossing salience and fluency manipulations provides a more direct test of whether salience increases liking independent of fluency effects. Readable (i.e., fluent) stimuli were light gray against a black background or dark gray against a white background, which we adapted from previous research (Reber et al., 1998). For half of participants, the salient stimulus was also fluent and the other (nonsalient) stimuli in the scene were disfluent; for the other participants, the salient stimulus was disfluent while the other (nonsalient) stimuli in the scene were fluent. We hypothesized that liking, evaluative extremity, and emotional intensity would be higher for the salient stimuli than the nonsalient stimuli. We expected fluency to increase liking as well, as in previous research (Claypool, Hugenberg, Housley, & Mackie, 2007; Reber et al., 1998; Topolinski & Strack, 2009; Winkielman et al., 2003), meaning that there would be main effects of both the salience and fluency manipulations.

Method

Participants. We requested 200 American adults from MTurk. These individuals participated in exchange for \$0.90. Twenty dropped out of the study before viewing all three slide-shows and were removed before analyses (resulting $N = 180$; 105 men, $M_{\text{age}} = 35.34$).

Procedure. Participants were told they were participating in a study about how features of letters and words influence how memorable they are, using the same cover story as in Experiment 4. Following this cover story, participants were told they would be viewing Chinese characters and Turkish words. We used the same stimulus valence manipulation as in Experiment 4 to manipulate whether the Turkish and Chinese word stimuli were portrayed as positive words or negative words.

Participants then viewed and subsequently rated the first set of nine stimuli. They completed this procedure (of viewing stimuli and then rating stimuli) for the Turkish words and Chinese characters in two counterbalanced blocks. In each block, one stimulus was randomly assigned to be more salient, standing out relative to the others because it was a different color. For half of the participants, the salient stimulus was dark gray while the other eight stimuli were light gray; for the other half, the salient stimulus was light gray while the other eight stimuli were dark gray (see Figure 5). The salience manipulation was successful, as indicated by higher ratings of self-rated salience for salient color singletons than the other stimuli, $t(42.71) = 6.83$, $p < .001$.

巴	车	采	贝	八	长
长	不	才	采	才	连
册	连	贝	车	巴	册

册	车	巴	册	车	巴
八	采	才	八	采	才
长	连	不	长	连	不

Figure 5. Sample displays in Experiment 5 (the four cells of the 2×2 design). The two left panels depict one stimulus that is salient and fluent surrounded by eight nonsalient and disfluent stimuli. The two right panels depict one stimulus that is salient and disfluent surrounded by eight fluent, nonsalient stimuli. This design manipulated salience and fluency orthogonally, allowing tests of how salience and fluency independently influence evaluations.

Additionally, the background color was white for half of the participants and black for the other half.¹⁰ These two conditions were created to manipulate salience and fluency orthogonal to stimulus features (i.e., whether or not they were dark gray vs. light gray). Fluent stimuli were dark gray against a white background or light gray against a black background. The fluency manipulation was successful, as indicated by higher self-rated fluency for stimuli intended to be easy to read (i.e., light gray against a black background or dark gray against a white background) than stimuli intended to be difficult to read, $t(166.30) = 3.16, p = .002$.

Fluency and salience were manipulated orthogonally, meaning that for half of participants, there were eight fluent stimuli and one disfluent stimulus whereas for the other half, there was one fluent stimulus and eight disfluent stimuli. During stimulus presentation, the nine stimuli were presented on screen in a different order five times for 5 s each time.

Participants then rated each stimulus with the same items as in Experiment 4 that assessed liking, emotional intensity, evaluative extremity, evaluative strength, salience, and fluency. The items in the two-item salience and fluency scales had large positive associations which were nearly identical in size (salience: $b = 0.74, p < .001$; fluency: $b = 0.74, p < .001$). We did not include apprehension items in Experiment 5, to streamline the procedure (and given that there was little evidence in our previous experiments that apprehension might account for the results).

After completing this procedure of viewing stimuli and rating them for the first stimulus set, participants repeated this procedure for the second set. Finally, participants were asked a multiple-choice question about what they thought the researchers were studying, why they thought one stimulus in each set was a different color than the others, and they indicated their ethnicity and the same holistic thought item as in Experiment 4.

Results

Liking. As predicted, salience increased liking. Participants liked salient stimuli ($M = 0.51, SD = 1.69$) more than nonsalient

stimuli ($M = 0.15, SD = 1.56$), $t(177.29) = 4.39, b = 0.38, p < .001$. There was also an effect of fluency, suggesting that fluent stimuli were liked more ($M = 0.32, SD = 1.59$) than disfluent stimuli ($M = 0.05, SD = 1.54$), $t(177.45) = 4.52, b = 0.39, p < .001$. The Salience $\times$ Fluency interaction was not significant, $t(177.93) = 0.94, b = 0.29, p = .346$.

Figure 6 displays liking as a function of the salience and fluency manipulations. The effect sizes of the salience and fluency manipulations were similar ($b_{\text{salience}} = 0.38, 95\% \text{ CI } [0.21, 0.55]$; $b_{\text{fluency}} = 0.39, 95\% \text{ CI } [0.22, 0.56]$). Salient fluent stimuli were liked more ($M = 0.77, SD = 1.66$) than nonsalient fluent stimuli ($M = 0.27, SD = 1.58$) and salient disfluent stimuli were liked more ($M = 0.26, SD = 1.68$) than nonsalient disfluent stimuli ($M = 0.02, SD = 1.53$). Because the effect sizes of the salience and fluency manipulations were similar, liking was approximately the same for salient disfluent stimuli ($M = 0.26, SD = 1.68$) and for nonsalient fluent stimuli ($M = 0.27, SD = 1.58$).

Liking was positively associated with emotional intensity ($b = 0.12, p < .001$), evaluative extremity ($b = 0.04, p = .113$), and evaluative strength ($b = 0.11, p = .017$). The effect of salience on liking remained significant when controlling for emotional intensity, evaluative extremity, and evaluative strength, $t(183.30) = 2.19, b = 0.17, p = .029$.

Evaluative extremity and strength. Salience also increased evaluative extremity, consistent with predictions. Participants had more extreme evaluations of salient stimuli ($M = 1.39, SD = 1.07$) than nonsalient stimuli ($M = 1.17, SD = 1.04$), $t(28.49) = 3.62, b = 0.23, p = .001$. The fluency manipulation also increased evaluative extremity ($M = 1.25, SD = 1.03$; $M = 1.14, SD =$

¹⁰ The background color was constant throughout the whole study including the full Qualtrics survey, whether white (for one half of participants) or black (for the other half). Additionally, the background color and the color of the salient stimulus were the same for each set of stimuli, because we suspected seeing multiple conditions would call greater attention toward stimulus color and background color.

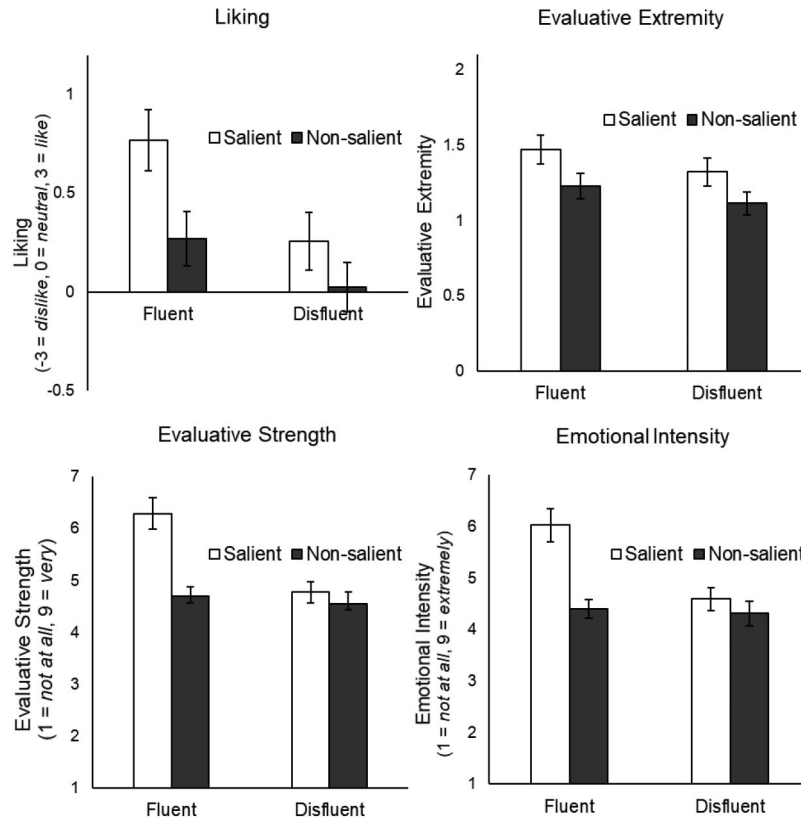


Figure 6. The salience manipulation increased liking, independent of fluency (that also increased liking, as in previous research). Error bars depict ± 1 adjusted standard error, following Cousineau (2005).

1.05), $t(175.49) = 2.42$, $b = 0.13$, $p = .017$, and there was no significant Salience $\times$ Fluency interaction, $t(177.60) = 0.17$, $b = 0.04$, $p = .867$.

Salience also increased the strength of stimulus evaluations ($M = 5.52$, $SD = 3.14$; $M = 4.63$, $SD = 2.68$), $t(22.83) = 5.43$, $b = 0.92$, $p < .001$, as did fluency ($M = 4.86$, $SD = 2.64$; $M = 4.58$, $SD = 2.83$), $t(177.38) = 6.26$, $b = 0.85$, $p < .001$. There was also an unhypothesized Salience $\times$ Fluency interaction, $t(176.64) = 2.36$, $b = 1.40$, $p = .019$, suggesting the effects of salience on evaluative strength were larger for fluent stimuli than disfluent stimuli.

Evaluative extremity and evaluative strength were positively associated with emotional intensity ($b = 0.08$, $p < .001$ and $b = 0.39$, $p < .001$, respectively). Important though, the effect of salience on evaluative extremity remained significant when controlling for liking and emotional intensity, $t(182.00) = 2.64$, $b = 0.14$, $p = .009$. Similarly, the effect of salience on evaluative strength remained significant when controlling for liking and emotional intensity, $t(183.20) = 4.27$, $b = 0.47$, $p < .001$. This suggests that the effect of salience on evaluative extremity and strength is at least partly independent of the effects on liking and intensity.

Perceived emotional intensity. Additionally, salience increased perceived emotional intensity. Participants reported more intense emotional reactions to salient stimuli ($M = 5.29$, $SD = 3.21$) compared with nonsalient stimuli ($M = 4.36$, $SD = 2.85$),

$t(27.95) = 4.85$, $b = 0.97$, $p < .001$. Fluency also increased perceived emotional intensity ($M = 5.29$, $SD = 3.21$; $M = 4.36$, $SD = 2.85$), $t(177.92) = 4.84$, $b = 0.77$, $p < .001$. There was an unhypothesized Salience $\times$ Fluency interaction, $t(177.37) = 2.19$, $b = 1.37$, $p = .030$, such that the salience effect on perceived emotional intensity was larger for fluent stimuli than disfluent stimuli. The effect of salience on emotional intensity remained significant when controlling for liking, evaluative extremity, and evaluative strength, $t(180.90) = 3.57$, $b = 0.45$, $p < .001$.

Moderation by stimulus valence. There was a marginal Salience $\times$ Stimulus Valence interaction, $t(178.39) = 1.92$, $b = 0.35$, $p = .057$. Though broadly consistent with the pattern in Experiment 4 wherein exposure had larger effects on positive than negative images, the interaction in Experiment 5 did not reach the conventional level of significance whereas the interaction in Experiment 4 did. Simple-effects tests revealed that salience increased liking for positive stimuli ($M = 0.96$, $SD = 1.54$; $M = 0.41$, $SD = 1.48$), $t(177.70) = 4.21$, $b = 0.55$, $p < .001$, but had a smaller, nonsignificant effect for negative stimuli ($M = 0.10$, $SD = 1.71$; $M = -0.09$, $SD = 1.59$), $t(178.17) = 1.66$, $b = 0.21$, $p = .098$. For negative stimuli, salience increased evaluative extremity and liking simultaneously. The effect of salience on liking remained significant when controlling for extremity, $t(93.32) = 2.10$, $b = 0.25$, $p = .038$, and the effect on extremity remained when controlling for liking, $t(93.17) = 2.14$, $b = 0.16$,

$p = .035$. Ratings of salience also predicted higher liking among negative stimuli, $t(89.61) = 4.87$, $b = 0.25$, $p < .001$, a relationship that increased slightly when controlling for evaluative extremity, $t(92.98) = 5.39$, $b = 0.27$, $p < .001$.

Discussion

These results demonstrate that directly manipulating salience without changing exposure frequency increased liking, evaluative extremity, and perceived emotional intensity. When integrated with our previous results, this provides evidence for a causal chain (Spencer et al., 2005) in which relative exposure increases salience (Experiments 3–4) and salience increases liking, evaluative extremity, and perceived emotional intensity (Experiment 5). Exposure increased salience in Experiments 1 and 2, which we demonstrated was attributable to relative exposure, not absolute exposure (Experiments 3 and 4). Experimentally increasing salience, in turn, increased liking, evaluative extremity, and perceived emotional intensity (Experiment 5).

Unsurprisingly, fluency also increased liking, consistent with previous literature (Reber et al., 1998; Winkielman & Cacioppo, 2001). This is consistent with the possibility that there is a causal chain from relative exposure to increased fluency to increased liking, in addition to the hypothesized chain through salience.

General Discussion

We investigated the idea that exposure influences evaluations by increasing salience. This idea was supported across five experiments. Using a mere exposure paradigm, repeated exposure consistently increased salience and this effect on salience accounted for a large proportion of the effect on liking in mediation models. Because salience is a relative quality of standing out in relation to other stimuli, we also demonstrated that relative exposure increases liking more than absolute exposure (Experiments 3–4). Furthermore, a direct manipulation of salience increased liking, consistent with a causal chain in which relative exposure increases salience and salience increases liking. These observations suggest that the traditional mere exposure effect, in which exposure increases liking, is at least partly attributable to salience.

We tested additional predictions derived from the salience explanation. Specifically, we tested whether repeated exposure increases evaluative extremity and emotional intensity. Repeated exposure consistently made evaluations more extreme and increased perceived emotional intensity (Experiments 1–4). A chain of experiments demonstrated that relative exposure increased salience (Experiments 1–4) and a salience manipulation increased evaluative extremity and emotional intensity, in addition to liking (Experiment 5). Mediation models were also consistent with the hypothesis that salience at least partially accounts for these effects.

Over one hundred previous experiments on mere exposure have been conducted. Most of these experiments have examined how exposure increases people's liking of stimuli (Montoya et al., 2017), though some have examined how exposure influences other outcomes such as stereotyping, false memory, and judgments of truth (Dechêne, Stahl, Hansen, & Wänke, 2009; Smith et al., 2006; Zaragoza & Mitchell, 1996). The present experiments broaden the scope of mere exposure research by demonstrating that relative exposure not only increases liking, but also impacts perceived emotional intensity and evaluative extremity.

These results have implications for theories of mere exposure. Previous theories explain exposure effects on liking as the result of increased fluency (Bornstein & D'Agostino, 1994; Reber et al., 1998; Winkielman & Cacioppo, 2001) or reduced apprehension toward repeatedly presented stimuli (Zajonc, 1968; Zebrowitz & Zhang, 2012). Results of multiple mediation models were consistent with the idea that salience partially accounts for exposure effects on liking, evaluative extremity, and perceived emotional intensity. Many of these mediation models suggested that fluency, in addition to salience, partially accounts for the effect of exposure on liking. Across all mediation analyses, however, fluency and apprehension accounted for less of the exposure effects than did salience.

In the present investigation, relative exposure increased liking more than absolute mere exposure (Experiments 3–4). This result is inconsistent with previous theories of mere exposure. For example, Zajonc states that it is absolute mere exposure that matters, and that between-participants exposure manipulations should be just as effective as within-participants manipulations (Moreland & Zajonc, 1976). A salience account of the mere exposure effect, in contrast, could explain why relative exposure increased liking more than absolute exposure. Of course, this does not mean that absolute exposure has no effect. There was a small effect of absolute (between-subjects) exposure on liking in Experiment 3, and the absence of a significant effect of absolute exposure in Experiment 4 does not mean that the effect is zero. But it does imply that the mere effect of absolute exposure may be smaller than implied by previous research. The more important finding in the present experiments is that relative exposure increases liking more than absolute exposure.

Some previous research might appear to contradict the idea that relative exposure increases salience, showing for example that a novel or oddball stimulus attracts more attention than familiar stimuli (Johnston, Hawley, Plewe, Elliott, & DeWitt, 1990). However, this effect is driven by whether the stimulus is a singleton rather than by novelty or exposure (Diliberto et al., 2000). When one novel or oddball stimulus is surrounded by several familiar stimuli, the novel stimulus attracts more attention. However, when one familiar stimulus is surrounded by several novel stimuli, the familiar stimulus attracts more attention (Diliberto et al., 2000). In other words, the stimulus that is most salient and contrasts from surrounding stimuli attracts attention independent of any effects of novelty or familiarity. Similarly, the finding from oddball paradigms in which an oddball stimulus captures attention is not driven by novelty (lower repetition), but rather by expectancy violation (Vachon et al., 2012). In our exposure experiments, we present several stimuli heterogeneously (that makes the next stimulus unpredictable) and present two stimuli at each level of exposure (so that either novel or familiar stimuli are singletons).

Nevertheless, there could be some contexts in which salience declines as a function of exposure. For example, if one stimulus appears many times in a row, a novel stimulus might be more salient because it violates expectations. Additionally, salience may decline after very long or frequent exposures, which might explain why liking sometimes decreases at very high exposure frequencies (Berlyne, 1970; Pieters, Rosbergen, & Wedel, 1999).

Salience Explains Other Mere Exposure Findings

The idea that salience accounts for exposure effects may explain several previous findings in the mere exposure literature. First, reviews and meta-analyses of mere exposure research have noted that the effects of exposure on evaluations are larger when stimulus presentation is heterogeneous compared with when stimulus presentation is homogeneous (Bornstein, 1989; Harrison & Crandall, 1972). In heterogeneous presentations, which are used in the vast majority of mere exposure research (Bornstein, 1989), several stimuli are presented within the same slideshow and exposure frequency of those stimuli is manipulated. In homogeneous presentation experiments, stimuli are presented one at a time, such that they do not compete for attention or salience. The meta-analytic finding that exposure effects are moderate in heterogeneous presentation experiments but small or absent in homogeneous presentation experiments is consistent with the idea that salience plays a role in these exposure effects.

Another observation from the mere exposure literature, which has not been previously brought to light, is that the relative frequency of exposure influences evaluations even when equating absolute exposure frequency. As noted in the introduction, for example, people like stimuli presented nine times more when other stimuli in the slideshow appear three times than when other stimuli in the slideshow appear 243 times. This result is difficult to explain if it is absolute mere exposure that underlies mere exposure effects. In contrast, differences in relative exposure and salience can easily explain this observation, because relative exposure increases salience much more than absolute exposure (Experiments 3–4).

Future Research

The present experiments raise several questions to be addressed in future research. For example, there are likely several variables that contribute to relative exposure effects. Future research should examine how salience and other variables mutually contribute to the effects of relative exposure on evaluations. For example, salience, accessibility, attention, evaluability, and feelings of interest, uncertainty, or boredom might all mutually contribute to relative exposure effects (Berlyne, 1970; Bornstein, Kale, & Cornell, 1990; Hsee, 1996; Lee, 2001).

Salience is multimodal and is closely associated with accessibility and attention (Taylor & Fiske, 1978). For example, when a political issue is made more salient by the news media, people have more accessible attitudes toward the issue, reporting their attitudes on the issue more quickly (Lavine, Sullivan, Borgida, & Thomsen, 1996). We conceptualize salience as shaped by both top-down and bottom-up factors. Salience comprises multiple components including attention, visual contrast, and subjective impressions of standing out. Future research might examine the degree to which these constructs are empirically separable and how much each component influences the effects of salience on liking and evaluative extremity, or whether all components contribute to the effects.

Repeated exposure likely increases salience and accessibility (Higgins, 1996; Wang et al., 1994), and future research might disentangle the effects of these constructs. We suspect that salience plays a larger role than accessibility for two reasons.

First, though accessibility may increase extremity (Downing et al., 1992), there is little evidence that it increases liking, so accessibility does not fully explain the effects of relative exposure and salience on liking in our experiments. Second, accessibility is an absolute quality typically operationalized as speed of retrieval from memory (Higgins, 1996). Accessibility should, therefore, be influenced by both absolute exposure frequency and relative exposure frequency whereas we found that relative exposure increases liking more than absolute exposure, consistent with a salience account.

Another important question for future research is how much the effects of exposure and salience emerge in less controlled naturalistic contexts. In the present experiments, we used mundane and relatively homogeneous stimuli to maximize statistical power (McClelland, 2000) and to facilitate comparison with results from previous mere exposure research (Montoya et al., 2017; Zajonc, 1968). However, these design elements also make it unclear to what extent the effects would generalize to more naturalistic contexts in the real world. The finding that effects generalize to familiar English words (Experiment 4) as well as positive stimuli (Experiments 4 and 5) suggest they generalize beyond neutral stimuli to evocative and familiar stimuli with which people have previous experience. It is possible that relative exposure and salience would have less influence among people with strong initial preferences or expertise. For example, art critics evaluating paintings, human resource experts evaluating job applicants, or financial advisors evaluating mutual funds may have extensive expertise and deeply established preferences so that salience would have smaller effects on liking than in our experiments. Additionally, the relative size of liking and extremity effects might differ across domains and stimuli, if for example salience effects on liking are moderated by expertise while salience effects on extremity are not. It is also possible that exposure effects would be smaller in heterogeneous environments, such as when people view both good and bad stimuli repeatedly (rather than viewing just one or the other). The large differences between good and bad stimuli might dwarf the smaller exposure effects.

Research on mere exposure has a rich history, encompassing over 100 experiments conducted over more than five decades (Montoya et al., 2017; Zajonc, 1968). The present investigation suggests that exposure increases salience, evaluative extremity, and emotional intensity, in addition to liking. The experiments support a novel explanation of mere exposure effects, suggesting that mere exposure influences evaluations not only by increasing fluency, but also by increasing salience. Exposure may not be so mere after all.

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(Appendices follow)

Appendix A

Text of Cover Stories and Funnel Debriefing

Cover Stories

- Experiments 1–3. We are studying memory for words, shapes, and characters. Specifically, we are interested in testing how good people are at remembering words (and word-like letter strings) compared with how well people can remember shapes and symbols. Are people especially skilled at remembering words? Do people only remember shapes and symbols after being exposed to them many, many times? Do people remember words after being exposed to them just one or two times?
- Experiments 4–5. The primary purpose of this study is to examine how features of letters and words influence how memorable they are. For example, we will examine whether the number of vowels or consonants in a word influences memory for words, and whether words/characters with sharp edges, acute angles, or complex shapes are remembered better (or worse) than words/characters that have no edges, obtuse angles, or simple shapes. We are also interested in how features like consonants, sharp edges, and complex shapes influence how much people like or dislike words.

Funnel Debrief

- Experiments 1–3. Debrief was similar for Experiments 4–5 (see online supplemental materials for details).
1. What do you think was the research question that the experimenters were testing?
 2. Which of the following do you think the researchers were studying? (multiple choice)
 - a. Whether people are better at remembering words and word-like letter strings compared with shapes and symbols.
 - b. Whether people are better at remembering pictures pre-

sented a couple times compared with pictures presented more times.

- c. Whether people like words with familiar letters more than words with unfamiliar (e.g., Chinese) characters.
 - d. Whether people remember pictures of words presented only one or a few times, but requires more presentations to remember symbols and shapes.
 - e. Whether people like pictures presented more times more than pictures presented fewer times.
 - f. Whether features of symbols and shapes (e.g., sharp edges) influence whether it is perceived to be good or bad.
3. Why were some words, characters, or shapes presented more times than others?

Salience Interpretation

- Experiment 4. You were asked to rate how salient each word was and how much it stood out to you. Which of the following best describes how you interpreted “salient” and “stood out”?
- a. How much the word stands out in my mind compared with the other words.
 - b. How much the word stands out visually, compared with the other words.
 - c. How many times the word was presented.
 - d. How much I like the word.
 - e. How easy the word was to process quickly and perceive clearly.
 - f. How strong my attitude is toward the word.
 - g. How familiar the word seemed.
 - h. How intense my emotional reaction to the word is.

(Appendices continue)

Appendix B

Contrast Codes and Results of Mixed Effects Models for Liking, Experiments 1–5

Table B1

Results of a Linear Mixed Model Estimating Liking in Experiment 1

Fixed effects	<i>b</i>	<i>SE(b)</i>	<i>t</i>	<i>p</i>
Intercept	0.30	0.09	3.53	<.001
Exposure (−1 = 0 exposures, 0 = 3 exposure, 1 = 9 exposures)	0.27	0.04	6.62	<.001
Exposure Contrast 2 (−1/3 = 0 exposures, 2/3 = 3 exposures, −1/3 = 9 exposures)	0.03	0.07	0.42	.681

Table B2

Results of a Linear Mixed Model Estimating Liking in Experiment 2

Fixed effects	<i>b</i>	<i>SE(b)</i>	<i>t</i>	<i>p</i>
Intercept	0.37	0.07	5.10	<.001
Exposure (−1.5 = 0 exposures, −.5 = 1 exposure, .5 = 3 exposures, 1.5 = 9 exposures)	0.03	0.02	1.17	.250
Exposure Contrast 2 (.5 = 0 exposures, −.5 = 1 exposure, −.5 = 3 exposures, .5 = 9 exposures)	0.02	0.05	0.52	.606
Exposure Contrast 3 (−.5 = 0 exposures, 1.5 = 1 exposure, −1.5 = 3 exposures, .5 = 9 exposures)	0.00	0.02	0.22	.826
Target (.5 = target, −.5 = nontarget)	0.66	0.07	9.58	<.001

Table B3

Results of a Linear Mixed Model Estimating Liking in Experiment 3

Fixed effects	<i>b</i>	<i>SE(b)</i>	<i>t</i>	<i>p</i>
Intercept	0.34	0.06	5.86	<.001
Exposure (−1 = 1 exposures, 0 = 3 exposures, 1 = 9 exposures)	0.19	0.04	4.47	<.001
Exposure contrast 2 (2/3 = 3 exposures, −1/3 = 1 exposure or 9 exposures)	0.02	0.07	0.32	.751
No exposure dummy (1 = 0 exposures, else 0)	−0.50	0.05	−9.96	<.001
Within vs. Between Contrast (1/2 = within-participants, −1/2 = between-participants)	−0.23	0.04	−5.44	<.001
Exposure × Within versus Between Contrast	0.17	0.08	2.12	.035
Exposure Contrast 2 × Within versus Between Contrast	−0.07	0.12	−0.55	.581

Table B4

Results of a Linear Mixed Model Estimating Liking in Experiment 4

Fixed effects	<i>b</i>	<i>SE(b)</i>	<i>t</i>	<i>p</i>
Intercept	0.35	0.16	2.20	.028
Relative exposure (−1 = lowest relative exposure, 0 = moderate relative exposure, 1 = highest relative exposure)	0.20	0.07	3.04	.003
Relative exposure contrast 2 (−2/3 = moderate relative exposure, 1/3 = highest or lowest relative exposure)	−0.03	0.05	−0.59	.557
Absolute exposure (exposure frequency)	−0.02	0.02	−0.83	.410
Quadratic absolute exposure (exposure frequency squared)	0.00	0.00	−0.31	.756

(Appendices continue)

Table B5

Results of a Linear Mixed Model Estimating Liking in Experiment 5

Fixed effects	<i>b</i>	<i>SE(b)</i>	<i>t</i>	<i>p</i>
Intercept	0.33	0.09	3.79	<.001
Salience (−.5 = nonsalient/same color as seven other stimuli, .5 = salient/different color than other eight stimuli)	0.38	0.09	4.39	<.001
Fluency (−.5 = difficult to read/light gray against white background or dark gray against black background, .5 = easy to read/light gray against black background or dark gray against white background)	0.39	0.09	4.52	<.001
Salience × Fluency	0.29	0.30	0.94	.346

Appendix C

Multiple Mediation Model of the Target Effects (Experiment 2)

Testing Multiple Possible Mediators of the Effects of Target on Key Dependent Variables in Experiment 2

Outcome variable	Salience	Fluency	Apprehension	Salience–fluency	Salience–apprehension
Liking (Experiment 2)	0.14 [0.10, 0.18]	0.05 [0.03, 0.08]	0.03 [−0.003, 0.058]	0.09 [0.02, 0.04]	0.17 [0.12, 0.22]
Evaluative extremity (Experiment 2)	0.05 [0.03, 0.07]	0.01 [−0.0004, 0.0160]	−0.01 [−0.022, 0.002]	0.04 [0.02, 0.07]	0.04 [0.02, 0.06]
Emotional intensity (Experiment 2)	0.43 [0.34, 0.52]	0.01 [−0.002, 0.034]	−0.03 [−0.063, 0.004]	0.41 [0.32, 0.50]	0.40 [0.31, 0.49]

Note. The statistics in the first three columns are indirect effects (ab), and the last two columns provide the difference between two indirect effects (Preacher & Hayes, 2008). Preacher and Hayes (2008) multiple mediation bootstrapping procedure was used to estimate indirect effects, and comparison of indirect effects. Brackets provide 95% confidence interval (CI) of indirect effects. Statistics are rounded to two decimal places, except in cases where additional decimal places are needed to determine whether the 95% CI excludes zero.

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