Salience in Mere Exposure:

Salience Makes Evaluations More Extreme and Accounts for Exposure Effects

By

Kellen Mrkva

B.A., 2012, University of Notre Dame

M.A., 2017, University of Colorado Boulder

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written by Kellen Mrkva
has been approved for the Department of Psychology and Neuroscience

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Dr. Leaf Van Boven (Chair)

_____
Dr. Charles Judd

_____
Dr. A. Peter McGraw

_____
Dr. Philip Fernbach

_____
Dr. Matthew Hallowell

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Thesis directed by Professor Leaf Van Boven

Abstract

I propose and support a salience account of exposure effects suggesting that repeated exposure to stimuli influences evaluations and emotion by increasing *salience,* the relative quality of standing out in relation to other stimuli in the environment. From this idea that exposure increases salience, I derive the hypotheses that repeated exposure to stimuli will make evaluations more extreme and emotional reactions more intense (in addition to increasing liking as in previous mere exposure research; Montoya et al., 2017; Zajonc, 1968). In Experiments 1 and 2, I manipulate exposure, presenting some stimuli 9 times and other stimuli 3 times, 1 time, or 0 times, as in previous research. Repeated exposure consistently made evaluations more extreme while intensifying emotional reactions to stimuli (Experiments 1-3). Consistent with previous research, exposure also increased how much people liked stimuli (Experiments 2-3). Because salience is a relative quality of standing out in relation to other objects in the environment, I also hypothesized and demonstrated that relative exposure is more impactful than absolute exposure (Experiment 3). Across experiments, results are consistent with the idea that salience mediates these effects of repeated exposure on evaluative extremity, emotional intensity, and liking. Contrary to previous theories of mere exposure effects, fluency (Winkielman et al., 2003) and lower apprehension (Harrison, 1977; Zajonc, 1968) did not account for the effect of exposure on liking (nor the effects on extremity or intensity). In Experiment 4, I directly manipulated salience by making one stimulus in a scene stand out (by presenting one diagonal stimulus surrounded by several vertically-oriented stimuli or one vertical stimulus surrounded by several diagonal stimuli). Salience made evaluations more extreme and increased emotional intensity. These findings have theoretical implications for mere exposure and practical implications for advertising and everyday life.

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

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CONTENTS

TABLES

Table

FIGURES

Figure

In everyday environments, many things compete for people's attention. Amid these cluttered environments, people can only attend to a subset of stimuli (Desimone & Duncan, 1995; Egeth & Yantis, 1997; Kahneman, 1973; Niebur & Koch, 1998). The visual salience of stimuli powerfully impacts what people attend to: That is, salient objects, people, and products attract attention more than less salient objects (Itti, Koch, & Niebur, 1998; Itti & Koch, 2001; Walther & Koch, 2006).

Salience, the quality of standing out relative to other objects in a context (Taylor & Fiske, 1991), not only influences attention. Salience also impacts evaluations and decision making. Making positive attitudes, positive objects, or neutral objects more salient and accessible causes them to become more positive and extreme (Brauer, Judd, & Gliner, 1995; Downing, Judd, & Brauer, 1992; Kirby, 2014; Sadler & Tesser, 1973). Making negative attitudes or people more salient and accessible causes them to become more negative and more extreme (Downing et al., 1992; McArthur & Solomon, 1978; Sadler & Tesser, 1973).

In addition to these effects on evaluations, salience influences choice and decision making (Bordalo, Gennaioli, & Shleifer, 2012; Johnson & Busemeyer, 2016). Specifically, making an object or attribute more salient during a decision increases weighting of that attribute (Fujii & Takemura, 2003; Mormann & Frydman, 2016).

Salience

Salience is the extent to which objects stand out relative to other stimuli in the environment or context (Taylor & Fiske, 1991). These other objects in the environment include objects presented in different locations and at different times (Strack, Erber, & Wicklund, 1982; Taylor & Fiske, 1978). Objects interfere with one another's salience more when they are presented close together in time and space, compared to when they are presented far apart (Grice,

Boroughs & Canham, 1984; Kihara, Yagi, Takeda, & Kawahara, 2010; Theeuwes, 1995). Salience is a relative quality, unlike color saturation, brightness, and many other variables that are absolute and typically measured on absolute scales.

Researchers have investigated many types of salience including visual salience, auditory salience, and salience in memory. Sights, sounds, thoughts, and memories that stand out relative to others are all salient.

Relationship to other related constructs

Salience is closely related to several other constructs including accessibility, vividness, and attention. These variables are all positively associated with one another (Taylor & Fiske, 1978). Higgins's (1996) model of attitude accessibility states that accessibility and activation are impacted by the frequency and recency of exposure to the attitude object, as well as the extent to which the attitude is relevant, applicable, and salient within the present context. 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). Or when salience is manipulated by requiring people to repeatedly rehearse attitudes on one issue but not on another issue, the repeatedly-rehearsed issue is more accessible (i.e., reported more quickly; Downing et al., 1992). Salience is also closely associated with vividness and attention (Taylor & Fiske, 1978). Visually salient objects that stand out because of a different color or orientation are much more likely than non-salient objects to attract attention (Itti et al., 1998). Increasing the relative attention and salience of an image makes it seem more vivid (Fuller & Carrasco, 2006; Mrkva, Westfall, & Van Boven, 2018)

Yet salience is not synonymous with any of these other constructs. One factor that differentiates salience from accessibility is that salience is a broad quality. Accessibility always

refers to the ease of retrieval from memory. In contrast, salience can refer to sights, sounds, thoughts, or memories that stand out.

A second factor that differentiates salience from accessibility and vividness is that salience is a relative quality (Fiske & Taylor, 1991). Accessibility is an absolute quality typically operationalized as speed of retrieval from memory. Vividness is an absolute quality impacted by the brightness and saturation of an object's colors. In contrast, salience is relative. Salience and vividness are clearly dissociable; when one dull green apple is surrounded by many bright red apples, the green apple is more salient despite being less bright and vivid (Itti et al., 1998). Computational models of salience show that bottom-up attention is driven primarily by relative salience; thus a dull green apple will be more likely to attract attention than one of many bright red apples that surround it (Itti et al., 1998).[1]

Attention is closely associated with salience (Itti et al., 1998) and, like salience, is a broad construct, comprising visual attention, auditory attention, and mental attention (Chun, Golomb, & Turk-Browne, 2011). Unlike attention though, salience can be measured as a property of a stimulus in a given environment. In contrast, attention is a property of the perceiver and cannot exist independent of the perceiver (Posner, Snyder, & Davidson, 1980). A single green apple surrounded by many red apples is salient even if an observer is not present (e.g., Perzzi, Krahenbuhl, Pritch, & Hornung, 2012). Attention requires a perceiver and is the act of focusing on a sight, sound, thought, or memory (Chun et al., 2011).

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[1] Availability is a construct which is sometimes equated with accessibility and sometimes defined in a different way. In some memory research, availability is defined as a binary variable of whether or not something is present or absent in memory storage (Tulving & Pearlstone, 1966). In other research, availability is conceptualized as the ease of retrieval from memory. In their research on the availability heuristic, Tversky and Kahneman use availability to mean the ease of retrieval from memory; they also clarify that their use of availability is different from Tulving's definition (Tversky & Kahneman, 1973, p. 208). The availability heuristic is a mental shortcut people use to judge the frequency of a target (or other attributes) based on the ease with which the target or relevant information about the target comes to mind.

Determinants of salience

Several factors influence the extent to which a stimulus stands out relative to other stimuli in an environment. The factors that influence salience have typically been examined in static images and scenes, however recent research has begun to focus more on dynamic factors that influence salience.

Determinants in static scenes. Contrast is one frequently-studied factor that influences salience. For example, a green object is more salient when most objects in its surroundings are red than when it is surrounded by many other green objects (Bundesen & Pedersen, 1982; Carter, 1982; D'Zmura, 1991; Farmer & Taylor, 1980; Green & Anderson, 1956). Similarly, when a stimulus has a different orientation than others nearby, it is more salient. For example, a single diagonal line is very salient when surrounded by many horizontal or vertical lines (Landy & Bergen, 1991; Nothdurft, 1991; Sagi, 1990). The degree to which the color or orientation is different from other objects in its surroundings also impacts salience. For example, a yellow-green apple does not stand out as much amid green apples as a red apple does. Or a line tilted 5 degrees from vertical does not stand out as much amid vertical lines as one tilted 45 degrees does (Duncan & Humphreys, 1989).

Contrast can be divided into two types: local contrast and global contrast. The local contrast of an object is the extent to which it is different (in color, orientation, and other features) from objects bordering and immediately surrounding it. Global contrast is the extent to which an object is different from the scene as a whole (measures of global contrast typically give each part of the scene equal weight; Cheng, Zhang, Mitra, Huang, & Hu, 2015). Both global and local contrast matter. A green object attracts more attention when there are many red objects in the scene, even if all of the red objects are very distant from the green object (Cheng et al., 2015).

But local contrast increases salience even beyond global contrast. The importance of local contrast is evident even at very early areas of visual processing in the visual cortex. For example, a neuron that fires when a vertical line is present in its receptive field does not fire as quickly if a second vertical line is just outside the center of its receptive field (Levitt & Lund, 1997). In other words, these visual cortex neurons fire more quickly when local contrast is high.

Determinants of salience over time. Salience is also dynamically determined, influenced not only by the present scene but by motion, past exposure, and experience. For example, changes in motion increase salience (Abrams & Christ, 2003, 2005; Howard & Holcombe, 2010). Other changes to an object over time, such as a changes in color, are salient (as long as there is only one change occurring at a given time; von Muhlenen, Rempel, & Enns, 2005). This coheres with the research on color contrast and orientation contrast. If an object stands out from others in the scene (e.g., different color) or contrasts from itself at previous times (e.g., changes color or begins to move), it is salient. Additionally, objects are salient if they contrast from prototypes in memory (Treisman & Gormican, 1988). And novel objects are usually salient (Johnson, Hawley, Plewe, Elliott, & DeWitt, 1990). At very high levels of familiarity and exposure, objects become less salient and attention-grabbing (Pieters, Rosbergen, & Wedel, 1999).

Salience influences attributions, evaluations, and decision making

Salience research in social psychology has a long history. Many researchers in the 1970s investigated how increasing the salience of one person (or that person's surroundings) influences the attributions that observers make about that person's behavior. Salience also impacts evaluations and decision making in predictable ways. The literature on salience effects on attributions, evaluations, and decision making is reviewed below.

Visual salience influences attributions. Salience influences attributions of causality and influence. In one classic experiment, Taylor and Fiske (1975) manipulated the visual salience of people having a conversation, making one person visually salient and focal. Participants subsequently inferred that whichever person was most visually salient was having the largest causal impact on the conversation.

Visual salience also influences whether a person's actions are attributed to their personality or to the situation they are in. Making another person's situation and environment more visually salient (e.g., by watching a video from that person's first person perspective) causes people to attribute that person's actions more to their situation (Arkin & Duval, 1975; Storms, 1973). In contrast, making that person more visually salient (i.e., looking at the person rather than his/her surroundings) causes people to attribute more of that person's actions to personality characteristics rather than the situation (McArthur & Post, 1977; Storms, 1973; Taylor, Fiske, Close, Anderson, & Ruderman, 1977).

Salience polarizes evaluations. In addition to influencing attributions, salience makes evaluations more extreme, making positive evaluations more positive and negative evaluations more negative. For example, in one experiment students interacted with a person who was either arrogant and smug or cheerful and complimentary. Then, participants in the "high salience" condition were asked to focus their thinking on that person they had just interacted with while those in the "low salience" condition read an unrelated news story. Participants in the "high salience" condition subsequently evaluated the arrogant student more negatively and the cheerful student more positively than those in the "low salience" condition (Sadler & Tesser, 1973). Similarly, researchers have shown that making an attitude more salient and accessible makes it more extreme (Downing et al., 1992). That is, evaluations of positive attitudes become more

positive when they are made salient and accessible (Brauer et al., 1995; Kirby, 2014; Mrkva & Van Boven, 2017) and evaluations of negative attitudes become more negative (McArthur & Solomon, 1978). More recently, researchers have manipulated the visual salience of people involved in a violent altercation, finding that visual salience polarizes evaluations and punishments of the violent actions (Granot, Balcetis, Schneider, & Tyler, 2014).

Salience influences judgment and decision making. Salience also influences judgment and decision making by increasing the weight and priority given to salient attributes. This has been most frequently studied in choice between gambles involving two attributes: probability and value. Weber and Kirsner (1997) increased the salience of the value attribute by increasing the font size of value information. People gave more weight to the value information (relative to probability information) when the value information was presented in large font. Conversely, Fujii and Takemura (2003) manipulated the font size of probability information. They found that probability information was given more weight when it was presented in large font (i.e., people were more likely to choose the option with higher probability). Similarly, Mormann and Frydman (2017) found that presenting probability information in bold font makes people more likely to choose the higher-probability option.

Other researchers have used event splitting or unpacking to attempt to make probability or value information more salient. For example, Birnbaum (2008) conducted several experiments in which an event probability was listed using either one event or two event branches. For example, some participants were asked whether they would prefer $5 for certain or a gamble involving a 1% chance of $400, a 1% chance of $400, and a 98% chance of $0. For others, the two 1% chances were replaced with a single 2% chance of winning $400. This was intended to increase the salience of the gamble because information that takes up a larger area of space is

more salient (Pieters & Wedell, 2004). In this experiment, participants were more likely to choose the gamble when it is displayed as two separate 1% chances than if it is displayed as one 2% chance of the same outcome. According to his transfer of attention exchange model, Birnbaum (2008) argued that the branch splitting format increases attention to an option which increases that option's weight. Expected utility theory and prospect theory would each assume that the change in format would have no effect (e.g., Prospect Theory's editing rules assume that people combine the two 1% chances into a single 2% chance). However, the data is more consistent with a model in which adding branches or expanding an option increases its weight.

Salience influences weighting of other attributes and costs as well. For example, sales taxes are given more weight when they are made more salient on price tags (Chetty, Looney, & Kroft, 2009). Adding salient sales tax labels to products significantly reduces demand for the product, even though these people are able to estimate the product's sales tax when asked (Chetty et al., 2009; Goldin & Homonoff, 2013). Similarly, people give more weight to calorie labels on food when these labels are made more salient (even among people who read both salient and less salient labels; Goswami & Urminsky, 2016). Additionally, people give more weight to opportunity costs when they are made more explicit or salient (Read, Olivola, & Hardisty, 2017).

Recently, several models in economics have taken salience effects into consideration, accepting that the salience of information (beyond the mere presence or absence of information) influences decision making (Bordalo, Gennaioli, & Shleifer, 2012a; DellaVigna, 2009; Hirshleifer & Teoh, 2003; Reis, 2006; Sims, 2006). Perhaps most prominently, the salience theory of choice under risk has been proposed (Bordalo et al., 2012a), purporting to explain diverse phenomena including the endowment effect (Bordalo, Gennaioli, & Shleifer, 2012b),

decoy effects (Bordalo, Gennaioli, & Shleifer, 2015), and biases in judicial decision making (Bordalo et al., 2015) with the simple observation that people give more weight to salient attributes and information compared to non-salient ones.

Theories of Mere Exposure Effects

Hundreds of experiments have examined how repeated exposure to stimuli influences evaluations (Bornstein, 1987; Montoya, Horton, Vevea, Citkowicz, & Lauber, 2017; Zajonc, 1968). Researchers have examined the effects of repeated exposure on liking and have identified moderators and potential explanations of the effect. However, according to a recent meta-analysis, "existing models of mere exposure do not adequately account for the findings" (Montoya et al., 2017). In other words, the reason why exposure influences evaluations remains a mystery, despite hundreds of experiments across many decades of research. Of course, this does not mean that the existing explanations do not partially account for mere exposure effects.

One class of explanations have proposed that mere exposure effects are driven by an increase in fluency, defined as the ease of processing or perceiving stimuli. Priming and absolute exposure to stimuli increase fluency (Alter & Oppenheimer, 2008; Brown, Rips, & Shevell, 1985; Labroo, Dhar, & Schwarz, 2008). So, it is conceivable that this increase in processing fluency might help explain exposure effects. Different versions of fluency accounts have been proposed. According to the hedonic fluency account, fluency is itself marked with positive affect (Winkielman & Cacioppo, 2001; Winkielman et al., 2003). Therefore, with increased exposure, objects become more fluent and thus are associated with more positive affect. A second, related model proposes that fluency produces familiarity and this familiarity increases liking because it implies that the stimulus can be processed without danger (Carver & Scheier, 1990; Schwarz, 1990). According to a third model, the fluency/attribution model, fluency is itself neutral but can

get misattributed to a positive cause (Bornstein & D'Agostino, 1994; Jacoby & Dallas, 1981; Jacoby, Kelley, & Dwyan, 1989).

Another class of accounts of mere exposure effects (Harrison, 1977; Zajonc, 1968) are rooted in the idea that people evolved to be wary of novel stimuli and experience some immediate apprehension and uneasiness when encountering them. According to Zajonc, this instinctive apprehension subsides when people are exposed repeatedly to stimuli without any negative consequences. Building on this account and explaining it further, Harrison (1977) reasoned that just as positive events produce positive affect, absence of negative events (e.g., the absence of negative consequences during exposure to images) also produces positive affect because the possible negative event is not experienced.

Other explanations have been proposed as well, including a two-factor habituation-satiation model (Berlyne, 1970; Stang, 1973). Similar to Zajonc's affective model, the first stage of this model implies that a fear of the unknown causes initial apprehension that subsides after repeated exposure produces familiarity and habituation. This model also proposes a second process called satiation, in which very high levels of exposure cause a decline in positive affect. A recent meta-analysis supported the proposal that there is a quadratic effect of exposure; repeated exposure begins to decrease liking for stimuli after approximately 36 exposures (Montoya et al., 2017).

According to a recent meta-analysis, each account fails to predict several of the key meta-analytic findings (Montoya et al., 2017). For example, most accounts fail to explain why exposure has a larger effect in heterogeneous presentation studies compared to homogeneous presentation studies.

Moderators of Mere Exposure Effects

Meta-analyses and reviews of the mere exposure literature have uncovered several variables that moderate the size of mere exposure effects. First, effects of mere exposure are larger in heterogeneous presentation experiments than in homogeneous presentation experiments (Bornstein, 1989). Heterogeneous presentation experiments use several stimuli in a single slideshow and manipulate exposure such that some stimuli are presented with higher frequency than others within the same slideshow. This design manipulates the relative salience of stimuli in addition to absolute exposure. In contrast, in homogeneous presentation experiments, participants are exposed to all repetitions of one stimulus before advancing to the next stimulus (Harrison & Crandall, 1972). In this context, different stimuli are not competing for salience within a slideshow. According to meta-analyses and literature reviews, there was a moderate effect size of mere exposure on increased liking for heterogeneous presentations, but no significant effect for homogeneous presentations (Bornstein, 1989; Harrison, 1977).

Mere exposure effects are also larger when stimuli are initially novel and interesting. One series of experiments found that mere exposure fails to increase liking among participants who are bored upon repeated exposure (Borstein, Kale, & Cornell, 1990). For bored individuals, repeatedly-exposed stimuli may no longer be as salient (e.g., bored participants may be more likely to mind-wander or attend to other thoughts or objects; Mooneyham & Schooler, 2013). Another finding, perhaps related to the boredom result, is that mere exposure effects for simple stimuli have a stronger quadratic term, asymptoting more quickly than for complex stimuli (Harrison, 1977; Montoya et al., 2017). This has been interpreted as evidence that boredom and satiation occurs earlier for simple stimuli, reducing liking ratings for these stimuli more quickly after an initial increase in liking at low levels of exposure (Harrison, 1977). Finally, mere exposure research is typically conducted with novel stimuli, and some have suggested that

exposure effects are smaller for stimuli that are already familiar (Harrison, 1977). When a positive stimulus starts to become boring, attending to a new component of the stimulus can make people like it more (when evaluations would otherwise asymptote or decrease; Crolic & Janiszewski, 2016). This implies that making a stimulus seem more boring or interesting influences evaluations above and beyond the effects of repeated exposure.

Neither of the two meta-analyses of the mere exposure literature have tested initial valence of stimuli as a potential moderator (Bornstein, 1989; Montoya et al., 2017). A review of the literature reveals conflicting theories and inconclusive results. Most theories of mere exposure effects predict that mere exposure should make negative, neutral, and positive stimuli more positive (e.g., Harrison, 1977; Winkielman & Cacioppo, 2001; Winkielman et al., 2003; Zajonc, 1968). Some experiments are consistent with this pattern. Zajonc, Markus, and Wilson (1974) found that repeated exposure to portraits of initially-undesirable criminals and initially-desirable scientists increased how much participants liked both types of individuals. Similarly, Hamm et al. (1975) found that exposure made stimuli more positive, and that this effect was not moderated by the initial valence of stimuli. Other researchers have proposed that mere exposure makes evaluations less extreme (i.e., making evaluations of positive stimuli less positive and negative stimuli less negative; Dijksterhuis & Smith, 2002; Lambert & Jakobovits, 1960). Still others have found that mere exposure makes evaluations of negative stimuli more negative (Meskin, Phelan, Moore, & Kieran, 2013; Perlman & Oskamp, 1971; Siegel & Weinberger, 2012). Overall, it remains an open question whether exposure makes evaluations more extreme or simply more positive.

Salience in Mere Exposure

In the present research, I investigate the idea that salience plays an important, neglected role in mere exposure research. Of course, the idea that salience plays a role in mere exposure research implies that repeated exposure increases salience.

Previous research supports this idea that exposure increases salience. At least at low levels of exposure, repeated exposure to an object increases how salient and attention-grabbing it is when it is subsequently searched for (Chun & Jiang, 1998; Maljkovic & Nakayama, 1994). That is, a stimulus "pops out" from a scene and is much more salient among people who have recently been exposed to it or searched for it, and the stimulus is less likely to "pop out" among people seeing it for the first time (Maljkovic & Nakayama, 1994). Therefore, I hypothesized that repeated exposure increases salience.

Several hypotheses can be derived from this premise that repeated exposure increases salience (when the premise is combined with results of previous research). First, previous research demonstrates that salience increases evaluative extremity (Downing et al., 1992; Sadler & Tesser, 1973). If repeated exposure increases salience and salience increases evaluative extremity, then, all else equal, repeated exposure should increase evaluative extremity.

H1: Relative exposure makes evaluations more extreme

Second, previous research demonstrates that salience and attention increase emotional intensity. Making objects more visually salient intensifies emotional reactions to those objects, and decreasing objects' salience (through distraction, cognitive load, or repeatedly attending away from them) reduces the intensity of people's emotional reactions (Bantick et al., 2007; Mrkva et al., 2018; Schmidt, Richey, Buckner, & Timpano, 2009; Van Dillen & Koole, 1997). If repeated exposure increases salience and salience intensifies emotional reactions to stimuli, then repeated exposure should intensify emotional reactions.

H2: Relative exposure intensifies emotional reactions

As previously mentioned, the reasoning behind Hypotheses 1-2 was that repeated exposure increases salience and salience increases evaluative extremity and emotional intensity. Therefore, an ancillary hypothesis is that salience partially mediates these effects on evaluative extremity and emotional intensity. This hypothesis will be tested both with statistical mediation models and with a causal chain of experiments (i.e., examining whether a manipulation of exposure increases salience and whether a manipulation of salience increases these dependent variables).

H3: Salience partially accounts for the effects of exposure on evaluative extremity and emotional intensity

Additionally, because salience is a *relative* quality of standing out in relation to other stimuli in the environment, this suggests that relative exposure should be more impactful than absolute exposure. If one painting is presented in isolation, it will be salient whether it is presented one or nine times because there is nothing to interfere with its salience. However, when several paintings are presented in the same slideshow and compete for salience and attention (as in typical mere exposure experiments), exposure should have a large effect.

H4: Relative exposure impacts evaluations more than absolute exposure

Repeated exposure may also partially[2] account for the mere exposure effect, that exposure increases how much people like stimuli. Several observations from the literature on mere exposure support this hypothesis. In particular, the idea that salience plays a role in the mere exposure effect may explain why exposure effects are absent in homogeneous presentation

[2] I predict that salience partially (rather than fully) mediates these effects, because there is previous evidence that repeated exposure impacts other constructs such as fluency (and fluency, in turn, increases liking; Winkielman & Cacioppo, 2001).

experiments. Additionally, the idea that relative salience is intertwined with exposure could explain why repeated exposure makes evaluations of negative stimuli more negative (Kruglanski et al., 1996; Meskin et al., 2013) contrary to existing mere exposure theories (Harrison, 1977; Schwarz, 2000; Winkielman et al., 2003; Zajonc, 1968). A relative salience account may explain many other key findings from the meta-analysis as well, such as effects of boredom and satiation at very high exposure frequencies. As mentioned earlier, at very high levels of exposure and familiarity, additional exposures decrease salience (Pieters et al., 1999).

Finally, if it is true that relative exposure increases salience (Armel et al., 2008; Atalay, Bodur, & Rasolofoarison, 2012) and that salience increases positivity of positive and neutral objects (Downing et al., 1992; Kirby, 2014; Sadler & Tesser, 1973), it logically follows that, all else equal, relative exposure makes evaluations of these stimuli more positive (contributing to mere exposure effects).

H5: Salience partially accounts for the mere exposure effect on increased liking

Table 1.

	Prediction	**Tested in**
H1	Relative exposure makes evaluations more extreme	Experiments 1-3
H2	Relative exposure intensifies emotional reactions	Experiments 1-3
H3	Salience partially accounts for the effects of exposure on evaluative extremity and emotional intensity	Experiments 1-2, 4
H4	Relative exposure impacts evaluations more than absolute exposure	Experiment 3
H5	Salience partially accounts for the mere exposure effect on increased liking	Experiments 1-4

Summary of hypotheses and list of the experiments that tested each one

The Present Experiments

These five hypotheses were tested across four experiments. In Experiment 1 and 2, exposure was manipulated as in previous mere exposure research. I tested the premise that repeated exposure increases salience and the hypothesis that repeated exposure makes evaluations more extreme. In these experiments, I also tested whether exposure intensifies emotional reactions.

In Experiment 3, I tested the hypothesis that relative exposure is more impactful than absolute exposure, a prediction which was derived from the notion that salience, a relative quality, mediates these exposure effects. Experiments 1–2 also used mediation analyses to test whether salience (as opposed to other variables such as fluency or reduced apprehension) mediate the effects of exposure on evaluative extremity, emotional intensity, and liking. Finally, Experiment 4 tested whether a direct manipulation of salience (isolated from exposure) makes evaluations more extreme and more positive, and whether salience intensifies emotional reactions to stimuli.

Experiment 1

In Experiment 1, I sought to demonstrate that repeated exposure makes stimuli more salient. It was important to establish that exposure increases perceived salience, because all of the aforementioned hypotheses were derived from this premise.

Additionally, Experiment 1 tested the hypotheses that repeated exposure makes evaluations more extreme and intensifies emotional reactions. Previous research demonstrates that increased salience of attitudes makes evaluations more extreme (Downing et al., 1992; Sadler & Tesser, 1973). Additionally, there is evidence that making stimuli more salient and distinctive intensifies emotional reactions to these stimuli (Bantick et al., 2003; Mrkva et al., 2018; Schmidt et al., 2009; Van Dillen & Koole, 2007). If exposure increases salience and

salience increases evaluative extremity and emotional intensity, it is reasonable to hypothesize that exposure will increase evaluative extremity and emotional intensity.

To test these hypotheses, exposure was manipulated by presenting some images 9 times and others 3, 1, or 0 times within the same slideshow (Zajonc et al., 1971). I hypothesized that participants would have more extreme evaluations and more intense emotional reactions to images presented 9 times compared to those presented 3 times, 1 time, or 0 times.

There was a secondary manipulation which was intended primarily in order to replicate a previous finding that attending to target images increase their emotional intensity (Mrkva et al., 2018). This manipulation has been previously found to increase distinctiveness, which may be associated with salience. For this reason, we included this manipulation orthogonal to the exposure manipulation, expecting that it would increase emotional intensity and evaluative extremity.

Method

Participants. One hundred nine American adults from Amazon Mechanical Turk participated online in exchange for $1.00. Four participants dropped out of the study prior to viewing all three slideshows and were thus removed prior to analyses (resulting N = 105; 54 female, M_{age} = 34.12). Across all experiments, I sought samples of at least 100 participants in each condition, resulting in approximately 100 participants in within-subjects experiments and larger samples in between-subjects experiments. Participants who were using a smartphone or tablet were prevented from advancing beyond the consent form.

Procedure. In Experiment 1, participants viewed slideshows consisting of several images and exposure was manipulated by presenting some images 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. Participants were told that this research was investigating whether people remember words after being exposed to them just once 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 A displays all stimuli). These three sets of stimuli were used because they are the most commonly used types of stimuli in previous mere exposure research (Montoya et al., 2017), thus making our results more comparable to previous research. The order of the three blocks, which each contained one of the three sets of images, was counterbalanced.

In each block, participants first viewed a slideshow consisting of eight stimuli from the same stimulus set presented at four different levels of exposure. Two of the eight images were presented nine times, two were presented three times, two were presented one time, and two were not presented in the slideshow. Stimuli were presented for 1.0 seconds each time they appeared and a 1.0 second fixation cross was presented between each image.

After the slideshow, participants completed a measure of liking consisting of the two most common liking items in mere exposure research (Montoya et al., 2017): “How much do you like this image” (–3 = *dislike*, 0 = neutral, 3 = *like*; Zajonc, 1968) and “For each [character/word], indicate the extent to which you think it means something good or bad” (–3 = *very bad*, 0 = *neutral*, 3 = *very good*). These two items were combined in all analyses across experiments (r = .40 in Experiment 1; .35 < r < .50 in each experiment). Participants also were asked to indicate the intensity of their emotional reactions to each image (1 = *not at all intense*; 9

= *extremely intense*; Mrkva et al., 2018), to assess emotional arousal in addition to the liking (emotional valence) measure.

Participants also completed a manipulation check: "As the image(s) were presented, how salient was this image? In other words, how much did it stand out in this context?" (1 = *not at all salient*, 7 = *extremely salient*). This manipulation check was included to test the assumption that repeated exposure increases salience. Additionally, participants completed ratings of perceived fluency and apprehension, two variables associated with other accounts of mere exposure. Participants were asked "How easy is each image to process" (1 = *difficult to process*, 7 = *easy to process*; Lee & Aaker, 2004), and "To what extent does each image make you feel uneasy?" (1 = *not at all*, 5 = *extremely*; McNair, 1971).

Participants repeated this procedure of viewing a slideshow and rating images until they had viewed and rated all three sets of images. In each slideshow, there was an additional manipulation intended to replicate a previous finding that assigning an image as a "target" intensifies emotional reactions (Mrkva et al., 2018). Participants were asked to press a key on their keyboard each time the "target" image appeared in the slideshow, which is designed to increase the attention directed toward the target image.

Near the end of the experiment, participants were given a memory test. All 18 images that participants saw across the three slideshows were presented along with 12 foil images taken from the same stimulus sets. Participants were asked to indicate "Which of the below images, words, and characters did you see in the slideshows earlier?"

Finally, participants answered questions designed to assess whether they were aware of the true research question. These questions consisted of both an open-ended and multiple-choice version of a question asking what they thought the experimenters were studying, as well as a

question that asked “Why were some words, characters, or shapes presented more times than others?” To ensure that participants did not understand the true meaning of the Chinese characters and Turkish words, they were asked whether they spoke Mandarin or Turkish and whether they could comprehend any of the words they saw. All participants were included in the primary analyses reported below, but all significant effects remained significant when removing participants who spoke Mandarin or Turkish (see Supplemental Material; no participants correctly guessed the research question in Experiment 1).

Analytical approach

In all experiments, data were analyzed using linear mixed effect models. The models treated participants and stimuli as random factors to properly model error variance associated with both random factors, and to allow generalization across participants and stimuli (Judd et al., 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.

Results

To analyze the effect of exposure on each outcome variable, a linear mixed effects model was computed with the fixed effects of Exposure and Target as well as random effects of Participant and Stimulus. The full set of contrast codes[3] and results are provided in Appendix E.

Salience. As predicted, participants indicated that images they were exposed to more frequently were more salient than images they were exposed to less frequently, $t(30.45) = 5.64$, *b*

[3] Exposure 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). Exposure x Target interactions were not predicted (and, in exploratory tests, were not observed to be significant), so these interactions were not included in the models.

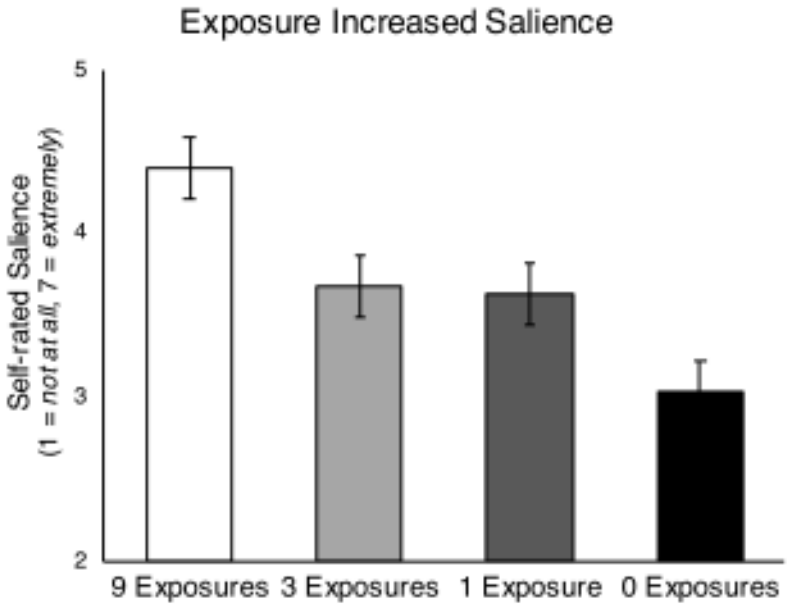
= 0.44, $p < .001$. Specifically, images presented 9 times were more salient (M = 4.40, SD = 1.99) than images presented 3 times (M = 3.68, SD = 1.88), 1 time (M = 3.36, SD = 1.79), or 0 times (M = 3.03, SD = 1.81). Target images were also rated as more salient than non-target images, $t(2357) = 11.42$, $b = 0.55$, $p < .001$.

Liking. Contrary to the prediction, there was no significant effect of exposure on how much participants liked the stimuli ($M_{9\text{ exposures}} = 0.18$, $SD = 1.27$; $M_{3\text{ exposures}} = 0.11$, $SD = 1.22$; $M_{1\text{ exposure}} = 0.10$, $SD = 1.21$; $M_{0\text{ exposures}} = 0.07$, $SD = 1.21$), $t(37.10) = 1.19$, $b = 0.03$, $p = .243$. The pattern of means across the four levels of exposure suggest that exposure if anything increased liking, however the effect in Experiment 1 was not significant. Target did increase liking, $t(2403) = 9.57$, $b = 0.35$, $p < .001$.

Evaluative extremity. Consistent with the hypothesis, exposure increased evaluative extremity. Evaluative extremity was computed as deviation from the neutral midpoint of the scale (Downing et al., 1992).[4] Exposure increased evaluative extremity, $t(34.40) = 2.09$, $b = 0.03$, $p = .044$. That is, participants rated stimuli presented 9 times further from the neutral midpoint (M = 1.04, SD = 0.87) compared to stimuli presented 3 times (M = 1.01, SD = 0.83), 1 time (M = 0.97, SD = 0.84), or 0 times (M = 0.96, SD = 0.84). To test whether exposure made negative evaluations more negative (contrary to many theories of mere exposure), the same evaluative extremity model was repeated while controlling for liking. In this model, the effect of exposure on evaluative extremity remained similar in size, $t(31.90) = 1.91$, $b = 0.02$, $p = .065$. Target also increased evaluative extremity, $t(240.70) = 2.86$, $b = 0.02$, $p = .004$.

[4] That is, extremity was the absolute value of liking ratings. Another evaluative extremity measure was computed as deviation of each rating from the average of that participant's ratings of the eight stimuli in the stimulus set. The results for this measure, which in general are similar to the results for the midpoint deviation measure, are provided in the Supplemental Material.

Emotional intensity. Consistent with the hypothesis, exposure increased emotional intensity, $t(32.10) = 4.88$, $b = 0.20$, $p < .001$. Specifically, participants reported more intense emotional reactions to stimuli they were exposed to 9 times ($M = 3.34$, $SD = 2.59$) compared to stimuli they were exposed to 3 times ($M = 3.12$, $SD = 2.44$), 1 time ($M = 3.01$, $SD = 2.43$), and 0 times ($M = 2.69$, $SD = 2.24$). Though the difference between 1 exposure and 0 exposures was the largest, $t(27.14) = 2.45$, $b = 0.26$, $p = .021$, there was also a significant difference between the 9 exposure and 1 exposure stimuli, $t(25.38) = 2.64$, $b = 0.37$, $p = .014$ and between the 9 exposure and 3 exposure stimuli, $t(25.08) = 2.33$, $b = 0.28$, $p = .028$, (but no significant difference between 3 exposures and 1 exposure, $|t| < 1$, $p > .25$). The effect of exposure on emotional intensity remained similar in size when controlling for evaluative extremity, $t(32.60) = 4.47$, $b = 0.19$, $p < .001$. And emotional intensity had a small positive correlation with evaluative extremity ($r = .22$). This suggests that evaluative extremity and emotional intensity are not identical constructs nor are the effects of exposure on these two variables redundant with one another. Target also increased emotional intensity, $t(2386.40) = 11.43$, $b = 0.58$, $p < .001$.



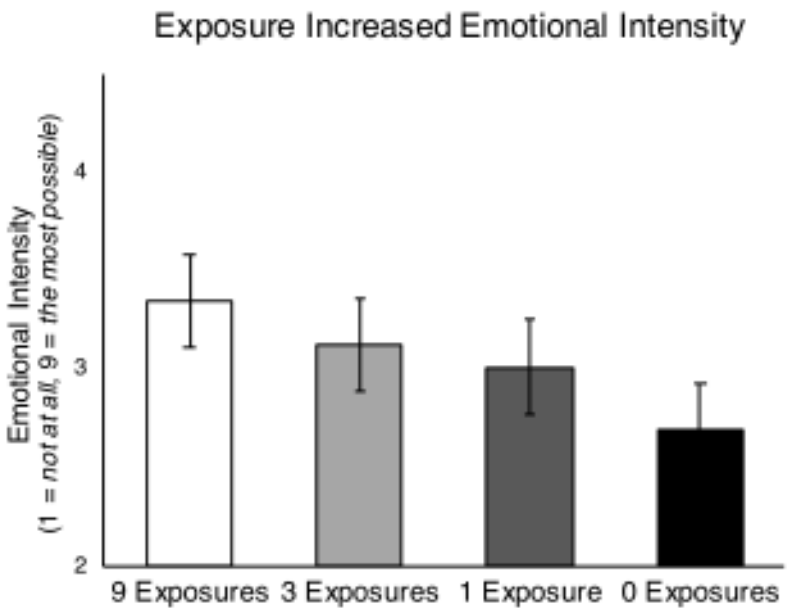


Figure 1. Effect of repeated exposure on salience (top panel) and emotional intensity (bottom panel) in Experiment 1. Error bars depict +/– 1 standard error.

Mediation analyses. I hypothesized that salience explains (at least partially) why exposure increases evaluative extremity, emotional intensity, and liking. Other theories of mere exposure propose that exposure increases liking by making stimuli more fluent (Winkielman et al., 2003) or by reducing apprehension (Harrison, 1977; Zajonc, 1968; Zebrowitz & Zhang, 2012). In Experiment 1, repeated exposure increased fluency, $t(2306) = 2.15$, $b = 0.06$, $p = .032$, but did not influence apprehension (i.e., uneasiness ratings), $t(22.30) = 0.95$, $b = 0.02$, $p = .354$.

I conducted multiple mediation analyses (Preacher & Hayes, 2008) to examine whether salience mediated each effect, and whether alternative mediators--fluency or apprehension--could account for each effect. For each of the three dependent variables (liking, emotional intensity, and evaluative extremity), a multiple mediation model was conducted with 5,000 bootstrapped resamples (following Preacher & Hayes, 2008). Each mediation analysis estimated the extent to which the effect of repeated exposure on the dependent variable was reduced when each potential mediator was added to the model. This statistic is also equivalent to an indirect

effect (i.e., the effect of salience on the mediator multiplied by the association between the mediator and the dependent variable, controlling for exposure; Preacher & Hayes, 2008).

There was an indirect effect consistent with the hypothesis that salience mediates the effect of exposure on emotional intensity (indirect effect ab = 0.09, 95% CI [0.05, 0.13]). In contrast, there was no significant indirect effect through fluency (ab = 0.00, 95% CI [–0.04, 0.04]), or apprehension (ab = 0.00, 95% CI [–0.04, 0.04]). This is consistent with the hypothesis that exposure increases emotional intensity by increasing salience (not by increasing fluency or reducing apprehension). For evaluative extremity, the multiple mediation model suggested that there was no significant indirect effect of exposure through salience, fluency, or apprehension, although the indirect effect through salience was nominally larger than the others (see Table 2).

As reported previously, repeated exposure did not significantly increase liking. Nonetheless, it can be informative to test whether there is an indirect of exposure on liking (e.g., whether exposure increases salience, which is associated with increased liking; Shrout & Bolger, 2002). This multiple mediation model, conducted with salience, fluency, and apprehension as possible mediators, showed that there was an indirect effect of exposure on liking through salience, ab = 0.03, 95% CI [0.003, 0.06]. This is consistent with the hypothesis that exposure increases salience which increases liking. There was no significant indirect effect through fluency (ab = 0.00, 95% CI [–0.03, 0.03]) or apprehension (ab = 0.00, 95% CI [–0.03, 0.03]).

Table 2.

Testing multiple possible mediators of the effects on key dependent variables in Experiments 1 and 2. The statistics are $c - c^1$, which is statistically equivalent to an indirect effect.

	Salience	Fluency	Uneasy
Emotional intensity (Experiment 1)	0.09 [0.05, 0.13]	0.00 [–0.04, 0.04]	0.00 [–0.04, 0.04]

Evaluative extremity (Experiment 1)	0.01 [–0.004, 0.03]	0.00 [–0.02, 0.02]	0.00 [–0.02, 0.02]
Liking (Experiment 1)	0.03 [0.003, 0.06]	0.00 [–0.03, 0.03]	0.00 [–0.03, 0.03]
Emotional intensity (Experiment 2)	0.28 [0.16, 0.40]	0.00 [–0.12, 0.13]	–0.02 [–0.14, 0.10]
Evaluative extremity (Experiment 2)	0.03 [–0.02, 0.09]	0.00 [–0.02, 0.02]	0.00 [–0.02, 0.02]
Liking (Experiment 2)	0.10 [0.01, 0.18]	0.02 [–0.07, 0.11]	0.03 [–0.05, 0.12]

Note. Preacher and Hayes (2008) multiple mediation bootstrapping procedure was used to estimate $c - c^1$, which is statistically equivalent to an indirect effect. This $c - c^1$ statistics are provided in the table above for each potential mediator(s) (95% confidence intervals are provided in brackets).

Discussion

Repeated exposure made stimuli seem more salient, which was a key assumption underlying all of the hypotheses. As predicted, repeated exposure also made evaluations more extreme and made emotional reactions more intense. Orthogonal to this, target images were rated as more salient, extreme, and emotionally intense, compared to non-target images. Mediation models were consistent with the hypothesis that salience accounted for the effect of exposure on emotional intensity. Mediation models were also more consistent with the hypothesis that repeated exposure increases salience, which increases liking (and less consistent with the alternative theories that exposure increases fluency or apprehension, which increase liking; Winkielman et al., 2003; Zajonc, 1968).

Experiment 2

In Experiment 2, I sought to replicate the effects of repeated exposure on evaluative extremity and emotional intensity. The procedure was similar to Experiment 1: Participants

viewed slideshows of stimuli and exposure was manipulated within-subjects. I hypothesized that repeated exposure would increase evaluative extremity and emotional intensity.

Method

Participants. One hundred sixteen American adults from Amazon Mechanical Turk participated online in exchange for $1.25. Sixteen dropped out of the study prior to viewing all three slideshows (resulting N = 100; 50 female, M_{age} = 36.39). Participants who were using a smartphone or tablet to access the survey were prevented from participating.

Procedure. Participants completed a similar procedure as in Experiment 1. They were given the same cover story. Then, they 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 blocks (order counterbalanced).

Exposure was manipulated such that two stimuli were presented 9 times, and two were presented 3 times within the slideshow (while the other four stimuli in the set were presented 0 times). Stimuli were presented for 1.0 second each time they appeared and a 1.0 second fixation cross was presented between stimuli.

Following the slideshow, participants completed all of the same ratings as in Experiment 2. A familiarity item was added because some fluency theories of mere exposure posit that fluency is associated with liking because it is a cue that a stimulus is familiar (Schwarz, 1990). Additionally, participants completed the recognition memory measure as in Experiment 1 as well as the same funnel debriefing procedure. Then, they were asked whether they spoke Mandarin or Turkish, whether they could comprehend any of the Mandarin or Turkish words, and they reported their level of boredom as well as whether they had seen any of the stimuli before.

Results

Salience. Salience was estimated as a function of Exposure as well as the random effects of Participant and Stimulus.[5] As predicted, exposure increased salience, $t(83.60) = 7.14$, $b = 0.76$, $p < .001$. On average, participants rated stimuli presented 9 times ($M = 4.38$, $SD = 1.98$) as more salient than stimuli presented 3 times ($M = 3.91$, $SD = 1.90$) or 0 times ($M = 2.87$, $SD = 1.91$). Simple effects tests revealed that stimuli presented 9 times were also rated as significantly more salient than stimuli presented 3 times, $t(19.68) = 3.98$, $b = 0.47$, $p < .001$, and stimuli presented 3 times were more salient than those presented 0 times, $t(66.56) = 5.93$, $b = 1.05$, $p < .001$.

Liking. Liking was also modeled as a function of the same fixed and random effects. Participants reported that they liked stimuli they were exposed to 9 times ($M = 0.30$, $SD = 1.55$) more than stimuli they were exposed to 3 times ($M = 0.05$, $SD = 1.46$) or 0 times ($M = –0.28$, $SD = 1.43$), $t(70.08) = 6.50$, $b = 0.26$, $p < .001$. This replicates previous research on mere exposure (Zajonc, 1968). Simple-effects tests revealed that liking ratings were greater after 9 exposures compared to 3, $t(33.36) = 2.77$, $b = 0.23$, $p = .009$, and after 3 exposures compared to 0, $t(30.64) = 3.60$, $b = 0.30$, $p = .001$.

Evaluative extremity. Exposure made attitudes more extreme. Evaluative extremity was computed as deviation from the neutral midpoint of the liking scale, exactly as in Experiment 1. Participants' attitudes were significantly more distant from the midpoint of the scale after more exposures, $t(24.85) = 3.42$, $b = 0.09$, $p = .002$. Participants had more extreme evaluations of stimuli presented 9 times ($M = 1.18$, $SD = 0.93$) compared to stimuli presented 3 times ($M =$

[5] Exposure was contrast-coded to compare (weights in parentheses) the 9 exposures (1) and 0 exposures conditions (–1) (3 exposures coded 0). A second contrast was included to keep the model orthogonal (3 exposures = ⅔ ; 0 and 9 exposures = –⅓).

1.11, *SD* = 0.88) or 0 times (*M* = 1.02, *SD* = 0.86). I also ran this analysis while controlling for liking in order to test whether exposure made negative evaluations more extreme (i.e., more negative). The effect of exposure on evaluative extremity remained significant and similar in size when controlling for liking, $t(30.10) = 2.84$, $b = 0.06$, $p = .008$. This suggests that the effect of exposure on extremity was not redundant with the effect on liking, and that exposure made negative evaluations more negative.

Emotional intensity. Additionally, participants reported more intense emotional reactions to stimuli they were exposed to more frequently, $t(34.54) = 4.48$, $b = 0.39$, $p < .001$. Specifically, participants had more intense emotional reactions to stimuli presented 9 times (*M* = 3.86, *SD* = 2.42) than those presented 3 times (*M* = 3.64, *SD* = 2.34) or 0 times (*M* = 3.08, *SD* = 2.14). Additionally, I tested whether the effect of exposure on emotional intensity was redundant with the effect on evaluative extremity. Emotional intensity was weakly correlated with evaluative extremity ($r = .16$). And the effect on intensity remained similar in size when controlling for evaluative extremity, $t(61.80) = 6.04$, $b = 0.38$, $p < .001$. This suggests that the two effects are not fully redundant with one another.

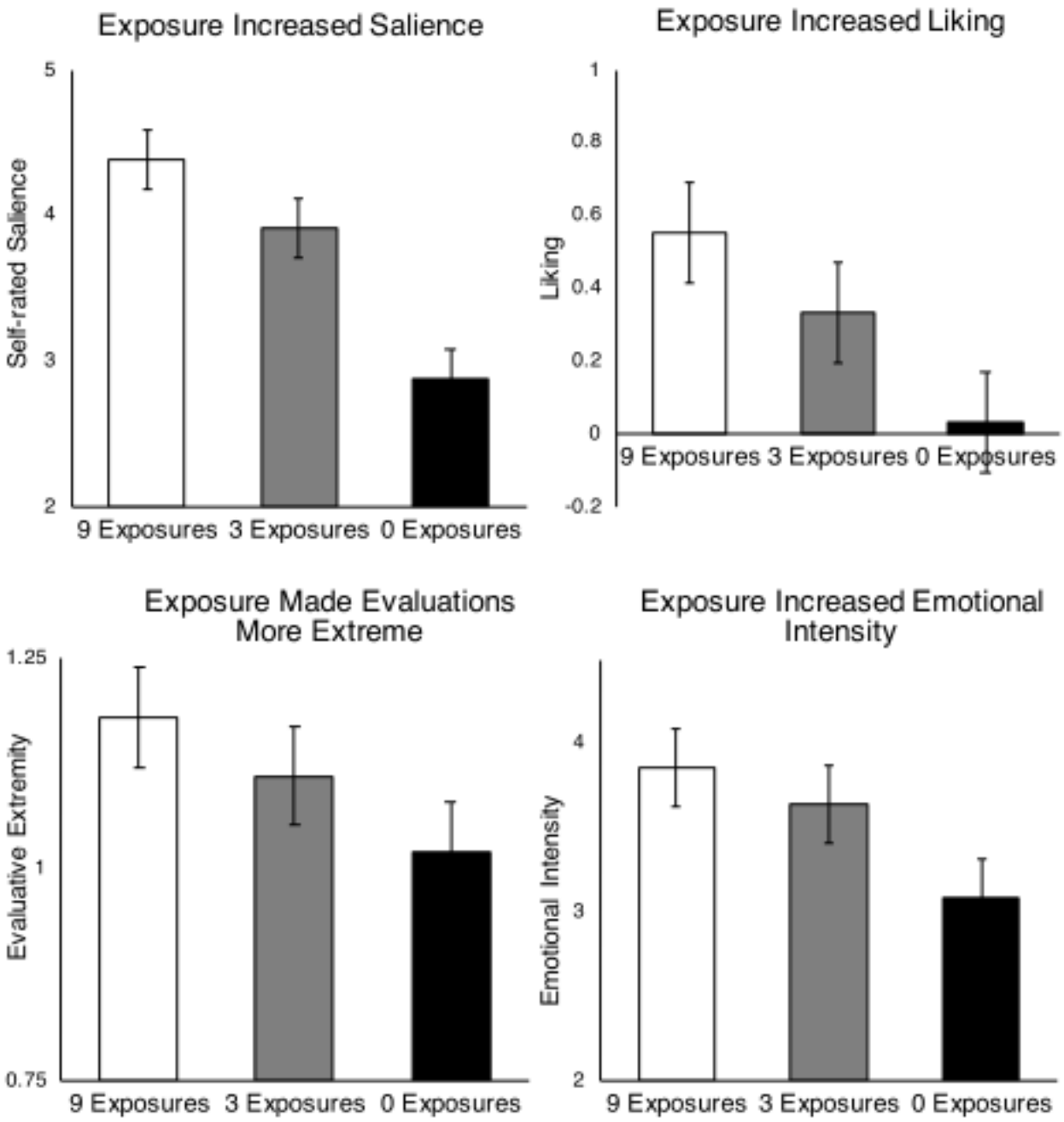


Figure 2. The effect of repeated exposure on salience, liking, evaluative extremity, and emotional intensity in Experiment 2. Error bars depict +/– 1 standard error.

Mediation analyses. Consistent with previous research, repeated exposure increased fluency, $t(22.81) = 5.21$, $b = 0.27$, $p < .001$ and decreased apprehension, $t(46.74) = –3.31$, $b = –0.12$, $p = .002$. It is therefore plausible that fluency or apprehension could account for the exposure effects, though I hypothesized that salience would partially account for them.

Multiple mediation analyses were conducted to examine the hypothesis that salience partially mediates the effects of exposure on liking, evaluative extremity, and emotional intensity. As in Experiment 1, these analyses also tested whether fluency or apprehension could account for each of the exposure effects. A multiple mediation model with salience as mediator (5,000 bootstrapped resamples, following Preacher & Hayes, 2008) revealed that there was an indirect effect of exposure on liking through salience as a mediator (ab = 0.10, 95% CI [0.01, 0.18]). In contrast, there was no significant indirect effect through fluency (ab = 0.02, 95% CI [–0.07, 0.11]) or apprehension (ab = 0.03, 95% CI [–0.05, 0.12]). This is consistent with the hypothesis that salience accounts for the effect of exposure on liking.

To test whether salience accounted for the effect of exposure on evaluative extremity, multiple mediation analyses were conducted with salience, fluency, and apprehension as mediators of the exposure effect on evaluative extremity. As in Experiment 1, there was no significant indirect effect through salience (ab = 0.04, 95% CI [–0.01, 0.10]), fluency (ab = 0.00, 95% CI [–0.02, 0.02]), or apprehension (ab = 0.00, 95% CI [–0.02, 0.02]), though the indirect effect through salience was nominally larger than the other two.

Multiple mediation analyses were also conducted to test the hypothesis that salience accounted for the effect of exposure on emotional intensity. There was an indirect effect through salience, (ab = 0.28, 95% CI [0.16, 0.40]), consistent with the hypothesis that salience accounts for this effect. In contrast, there was no significant indirect effect through fluency, (ab = 0.00, 95% CI [–0.12, 0.13]), or apprehension, (ab = –0.02, 95% CI [–0.14, 0.10]). This is consistent with the mediation analyses in Experiment 1 and suggests that salience may account for the effect of exposure on emotional intensity, whereas fluency and apprehension may not.

Discussion

In Experiment 2, repeated exposure increased emotional intensity and made evaluations more extreme. Unlike Experiment 1, repeated exposure also significantly increased how much participants liked the stimuli, replicating previous mere exposure research (Montoya et al., 2017; Zajonc, 1968).

Contrary to prevailing mere exposure theories (Harrison, 1977; Winkielman et al., 2003; Zajonc, 1968), mediation analyses suggested that fluency and apprehension did not mediate the effect of exposure on liking. The mediation analyses were more consistent with the hypothesis that salience mediates the effect of exposure on liking. Similarly, mediation analyses supported the hypothesis that salience accounts for the effect of exposure on emotional intensity.

Of course, mediation analyses cannot show that salience caused changes in these dependent variables. Therefore, the next two experiments will use experimental manipulations to isolate exposure from salience (Experiment 3) and directly manipulate salience (Experiment 4; allowing for causal inferences).

Experiment 3

In Experiment 3, I tested whether relative exposure is more impactful than absolute exposure. In nearly all mere exposure experiments, exposure is confounded with salience: High-exposure images are presented in the same slideshow as low-exposure images so that stimuli compete for salience. As a result, high-exposure stimuli are more salient than low-exposure stimuli in addition to being presented for a longer duration (as confirmed in Experiments 1 and 2). It is therefore difficult to know whether it is salience or mere exposure (or both) that produce exposure effects. Yet this is a theoretically important question: Does mere exposure itself increase liking, or is the exposure effect actually driven by salience?

In Experiment 3, I sought to isolate the effect of salience from the effect of mere exposure. To do so, I randomly assigned some participants to a within-subjects manipulation of exposure in which both mere exposure and salience increase. Other participants were randomly assigned to a between-subjects exposure manipulation which was designed to isolate exposure effects from salience. Some participants viewed stimuli 9 times while others viewed them 1 time, but there were no other stimuli competing for salience within the slideshow (thus the stimuli should be very salient in both conditions).

If salience drives mere exposure effects, the effects of exposure should be larger in the within-subjects condition (i.e., salience + exposure) than the between-subjects conditions (i.e., exposure alone). In contrast, if mere exposure is sufficient to increase liking (or other variables), exposure should have these effects even in the between-subjects conditions. I hypothesized that the effects of exposure on liking, evaluative extremity, and emotional intensity would be larger in the within-subjects condition than in the between-subjects conditions (as implied by a salience account of exposure effects).

Method

Participants. Four hundred twenty-three American adults from Amazon Mechanical Turk participated online in exchange for $1.00. Twenty-three dropped out of the study prior to viewing all three slideshows and were thus excluded prior to analyses (resulting N = 400; 223 female, M_{age} = 36.27).[6] Participants who had completed Experiment 1 or Experiment 2 were excluded from being able to participate as were participants who were using a smartphone or tablet.

[6] Four from the within-subjects condition dropped out, nine from the one exposure between-subjects condition, six from the three exposures between-subjects condition, and four from the nine exposures between-subjects condition.

Procedure. In Experiment 3, participants were randomly assigned to one of four conditions. In one condition, exposure was manipulated within-subjects as in Experiment 1. That is, 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 were designed to manipulate exposure between-subjects rather than within-subjects. Participants in each of these conditions viewed two stimuli per slideshow, but the number of times these two stimuli appeared was manipulated. One group of participants viewed two stimuli nine times each in every slideshow, another group viewed two stimuli three times each, and the final condition viewed two stimuli one time each.

Participants were given the same cover story as in Experiment 2. Then, they completed the following procedure with three sets of images--Chinese characters, Turkish words, and segments of an abstract art painting (in counterbalanced blocks). In each block, participants viewed a slideshow containing the images described above; images appeared for 1.0 second each time they were presented with a 1.0 second fixation cross between images.

Following this slideshow, participants rated eight images from the set, including all images presented in the slideshow and novel images from the same set. They completed the exact same measures as in Experiment 2, as well as one additional measure of how interesting each stimulus seemed.[7]

After these ratings, participants completed measures of recognition memory and boredom (exactly as in Experiment 2). Then, they completed the same funnel debriefing procedure as in

[7] This item was included so that, if between-subjects exposure decreased liking, it would be possible to test whether that occurred because the procedure was more boring for participants who viewed each stimulus 9 times. However, the between-subjects manipulation did not decrease liking, so we do not report the results of this item.

the previous experiments in order to assess whether any participants had become aware of the research question.

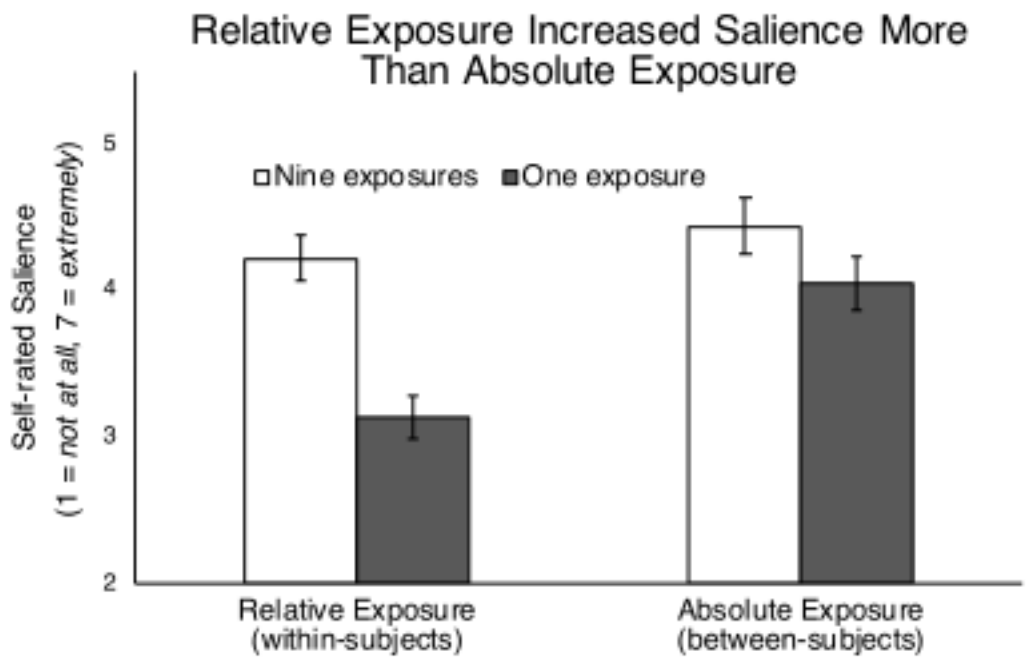
Results

To analyze the effect of exposure on each outcome variable, a bootstrapping procedure was used to estimate whether the effect of exposure on each variable was significantly larger in the within-subjects condition compared to the between-subjects condition. In each iteration of the bootstrapping procedure, 400 participants (i.e., the number of participants in the study) were sampled with replacement from the original dataset and the key difference-in-differences (i.e., Exposure x Condition interaction) was computed by subtracting the between-subjects difference (i.e., the average rating of stimuli presented 9 times minus average rating of stimuli presented 1 time among participants in the between-subjects conditions) from the within-subjects difference (i.e., average rating of stimuli presented 9 times minus average rating of stimuli presented 1 time among participants in the within-subject condition). This was done in 5,000 iterations (as recommended by Preacher & Hayes, 2008) with 400 participants sampled with replacement from the dataset each time. The 95% CI bounds of the difference-in-differences were computed by ordering the 5,000 difference-in-difference estimates from least to greatest and taking the 2.5 percentile and 97.5 percentile of the 5,000 estimates.

Salience. As predicted, exposure increased salience more in the within-subjects condition than in the between-subjects condition. The difference-in-differences was appreciably larger than zero (estimate: 0.70, 95% CI [0.22, 1.18]), supporting this hypothesis. Simple effects tests revealed that the effect of repeated exposure on salience was large in the between-subjects condition (estimate: 1.09, 95% CI [0.79, 1.39]) and was smaller though still significant when comparing the between-subjects conditions (estimate: 0.39, 95% CI [0.02, 0.76]). So, relative

exposure did increase salience more than absolute exposure, but absolute exposure alone was sufficient to increase salience.

Liking. Exposure increased how much participants liked stimuli (bootstrapped estimate: 0.37, 95% CI [0.22, 0.52]), consistent with previous mere exposure research (Bornstein, 1989; Montoya et al., 2017; Zajonc, 1968). As predicted, this effect of Exposure was larger in the within-subjects condition than the between-subjects conditions (bootstrapped estimate: 0.30, 95% CI [0.01, 0.62]). Simple effects tests revealed that exposure increased liking most in the within-subjects condition (estimate: 0.52, 95% CI [0.34, 0.73]), and the effect was smaller in the between-subjects condition (estimate: 0.22, 95% CI [–0.02, 0.45]).



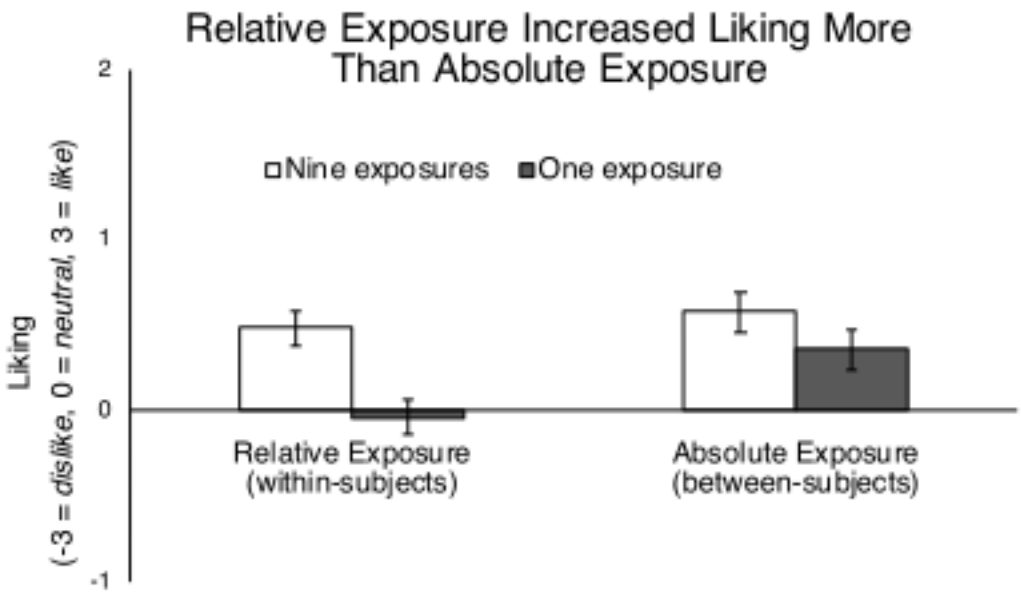


Figure 3. Effect of relative compared to absolute exposure on salience (top panel) and liking (bottom panel) in Experiment 3.

Evaluative extremity. Contrary to the hypotheses, the effect of exposure on evaluative extremity was not significantly larger in the within-subjects condition compared to the between-subjects condition (estimate: 0.10, 95% CI [–0.07, 0.26]). Simple effects tests revealed that repeated exposure did make evaluations more extreme in the within-subjects condition (estimate: 0.10, 95% CI [0.03, 0.18]), replicating Experiments 1-2. And exposure did not significantly influence extremity in the between-subjects conditions (estimate: 0.01, 95% CI [–0.14, 0.16]). Though the effect of relative exposure was not significantly larger than the effect of absolute exposure, this pattern of simple-effects is consistent with the hypothesis that relative exposure seems to increase evaluative extremity whereas absolute exposure does not.

Emotional intensity. Exposure also increased emotional intensity (bootstrapped estimate: 0.38, 95% CI [0.08, 0.68]), however this effect was not significantly larger in the within-subjects condition compared to the between-subjects condition, (estimate: 0.35, 95% CI [–0.25, 0.94]). Simple effects tests revealed that repeated exposure increased emotional intensity in the within-subjects condition (estimate: 0.55, 95% CI [0.33, 0.82]) and did not significantly

influence emotional intensity in the between-subjects condition (estimate: 0.21, 95% CI [–0.33, 0.73]).

Discussion

In Experiment 3, exposure made evaluations more positive and more extreme, and made emotional reactions more intense. Importantly, the effect on liking was larger when relative exposure was manipulated (i.e., within-subjects), compared to when absolute exposure was manipulated (between-subjects). This is consistent with the hypothesis that effects of exposure on liking are due in part to the heightened relative salience of high-exposure stimuli.

Across Experiments 1–3, repeated exposure to stimuli made evaluations of those stimuli more extreme and made emotional reactions more intense. Statistical mediation models in Experiments 1 and 2 were consistent with the hypothesis that repeated exposure had these effects because exposure increases salience. However, mediation models cannot unambiguously demonstrate that salience causes evaluations to get more extreme. Therefore, in Experiment 4, I sought to more directly manipulate salience to demonstrate that evaluations of stimuli can become more extreme when stimuli are made more salient.

Experiment 4

Previous mere exposure paradigms as well as Experiments 1 and 2 of this investigation used an exposure manipulation that increases both exposure and salience. So it is impossible to conclude whether salience caused the exposure effects or whether mere exposure caused the exposure effects.

Salience can also be isolated from exposure by making one stimulus stand out within a scene in which all stimuli are presented for the same amount of time. In Experiment 4, salience

was isolated from exposure and manipulated directly. This provides a test of the hypothesis that salience causally increases evaluative extremity, emotional intensity, and liking.

One element of a scene that impacts salience is local contrast--whether a stimulus is different in color, orientation, or other features relative to other stimuli in its immediate surroundings (Itti et al., 1998). For example, when one green apple is surrounded by many red apples or when one red apple is surrounded by many green apples, the one that is different from the others is much more salient (Bundesen & Pedersen, 1982; Carter, 1982; D'Zmura, 1991; Farmer & Taylor, 1980; Green & Anderson, 1956). Similarly, when one diagonal line is surrounded by several horizontal lines or when one horizontal line is surrounded by several diagonal lines, the line that is oriented differently from the rest is extremely salient (Landy & Bergen, 1991; Nothdurft, 1991; Sagi, 1990). In Experiment 4, stimulus salience was manipulated by randomly assigning one stimulus in each set to be oriented differently from the rest. Participants were randomly assigned either to view one diagonal stimulus surrounded by several horizontal stimuli or one horizontal stimulus surrounded by several diagonal stimuli. Thus, the design manipulated salience while controlling for possible inherent differences between diagonal and horizontal stimuli.

Method

Participants. Seventy-one undergraduates (45 female, M_{age} = 19.34) participated in exchange for course credit. They completed the study on computers in individual laboratory rooms.

Procedure. Participants were told that the researchers were investigating how people's evaluations of words, shapes, and lines are influenced by features of those stimuli. "For example,

we will examine whether the number of vowels or consonants influence how much people like words, and whether the number of edges in a shape influence how much people like shapes."

Following this cover story, participants viewed and subsequently rated a set of twelve stimuli. They completed this procedure (of viewing stimuli and then rating stimuli) in three blocks which each consisted of a different stimulus set (Turkish words, segments of an abstract art painting, and lines; order counterbalanced). In each block, one stimulus was randomly assigned to be more salient, standing out relative to the others because of a different angular orientation. For half of the participants, the one stimulus was oriented 20 degrees diagonally to the right while the other eleven stimuli were oriented horizontally. For the other half of the participants, one stimulus was oriented horizontally while the other eleven stimuli were oriented 20 degrees diagonally to the right (see Appendix F). These two conditions were created to manipulate salience orthogonal to stimulus features (i.e., whether or not they were rotated). During stimulus presentation, the twelve stimuli were presented on screen in a different order 5 times for 5 seconds each time.

Participants then rated each stimulus along the same dimensions as in Experiment 3: liking, emotional intensity, salience, fluency, familiarity, apprehension, and interest. Given study time constraints, one-item measures of liking and emotional intensity were used ("How much do you like this [word/image/line]?" and "How intense was your emotional reaction to this [word/image/line]?"), rather than the two-item measures used in Experiment 3.

Finally, participants were asked to indicate what they thought the researchers were studying, and why they thought one stimulus in each set was oriented differently than the others. They also reported their level of interest or boredom, whether they had seen any of the stimuli

before, and whether they spoke Turkish and could comprehend the meaning of the Turkish words.

Results

To analyze the effect of salience on each outcome variable, a linear mixed effects model was computed with one fixed effect of Salience, which was contrast-coded (weights in parentheses) to compare ratings of the stimulus that stood out (½) to ratings of the stimuli that did not (–½). Stimuli that "stood out" included the one rotated stimulus in a scene with eleven horizontal stimuli and the one horizontal stimuli in a scene with eleven rotated stimuli. Since I did not hypothesize any effect of Orientation (i.e., effect of whether a stimulus was rotated or not independent of salience) nor any moderation of the salience effect depending by condition (i.e., whether the one salient stimulus was rotated or not), I only included the fixed effect of Salience and report exploratory analyses of Orientation and Salience x Condition in the Supplemental Material.

Salience manipulation check. As predicted, stimuli that stood out were rated as more salient (M = 5.29, SD = 2.12) than stimuli that did not (M = 2.89, SD = 2.05), $t(63.89) = 8.07$, b = 2.35, $p < .001$. Thus, our manipulation of salience was successful.

Liking. There was no effect of Salience on how much participants reported liking the stimuli, $t(47.92) = 0.15$, $b = 0.02$, $p = .880$. Contrary to the hypothesis, stimuli that stood out (M = 0.26, SD = 1.71) were on average rated similar in liking to stimuli that did not stand out (M = 0.25, SD = 1.32).

Evaluative extremity. Evaluative extremity was computed ias deviation from the neutral midpoint of the liking scale as in the previous experiments. Stimuli that were manipulated to stand out were evaluated as more extreme relative to the neutral midpoint (M = 1.29, SD = 1.15)

compared to stimuli that did not stand out (M = 0.86, SD = 1.05), t(43.84) = 4.70, b = 0.43, p < .001. To test whether salience made negative evaluations more negative, the same evaluative extremity analysis was conducted while controlling for liking. The effect of salience on evaluative extremity remained when controlling for liking, t(58.66) = 4.51, b = 0.50, p < .001.

Emotional intensity. Stimuli manipulated to stand out from the scene were also more emotionally intense than the other stimuli. Participants reported more intense emotional reactions to stimuli that stood out (M = 3.95, SD = 2.52) compared to stimuli that did not (M = 2.99, SD = 2.14), t(40.08) = 4.73, b = 0.91, p < .001. The effect of salience on emotional intensity was not fully redundant with the effect of salience on evaluative extremity. That is, when controlling for evaluative extremity, the effect of salience on emotional intensity remained significant and similar in size, t(44.61) = 4.53, b = 0.82, p < .001. Emotional intensity was positively correlated with evaluative extremity (r = .34).

Alternative explanations. The manipulation was designed to increase stimulus salience, which was hypothesized to increase emotional intensity, liking, and evaluative extremity. It is possible, however, that the manipulation increased evaluative extremity and emotional intensity by making stimuli seem more familiar or disfluent, or by making participants apprehensive--variables previously associated with evaluations, emotion, and exposure effects. The salience manipulation did not influence ratings of fluency, t(190.39) = -0.09, b = -0.01, p = .928, although it did appear to increase perceived familiarity, t(62.95) = 3.13, b = 0.45, p = .003, and increase apprehension, t(52.37) = 3.55, b = 0.52, p < .001. More importantly, the effect of the salience manipulation on both emotional intensity and evaluative extremity remained when I controlled for ratings of fluency, familiarity, and apprehension (both ts > 3.0, both ps < .001). Thus,

salience increased emotional intensity and evaluative extremity, and these effects were not fully accounted for by fluency, familiarity, or apprehension.

Discussion

In Experiment 4, salience made evaluations more extreme and emotional reactions to stimuli more intense, even when salience was isolated from exposure and directly manipulated. When combined with results from the previous experiments, this provides evidence for a causal chain (Spencer, Zanna, & Fong, 2005) in which exposure increases salience and salience increases evaluative extremity as well as emotional intensity.

General Discussion

This investigation began with the premise that repeated exposure increases salience, a hypothesis that had not previously been tested in the mere exposure literature. From this premise, I derived a number of predictions that differ from and build upon previous mere exposure research. First, I hypothesized that exposure would impact other variables not previously studied in mere exposure research: emotional intensity and evaluative extremity. Second, I reasoned that if salience accounts for these effects, then relative exposure (i.e., exposure that is confounded with relative salience) should have a larger impact than absolute exposure (i.e., exposure that is isolated from relative salience). Third, I hypothesized that directly manipulating salience should increase emotional intensity and make evaluations more extreme. The results of Experiments 1–4 support these hypotheses.

Hundreds of previous experiments on mere exposure have focused on one effect of exposure--that repeated exposure increases how much people like stimuli. The present experiments broaden the scope of mere exposure research by demonstrating that repeated exposure not only increases liking, but also impacts emotional reactions and evaluative

extremity. That is, repeated exposure intensified emotional reactions to stimuli (Experiments 1–3) and made evaluations more extreme (Experiments 1–3).

These results have implications for theories of exposure effects. Previous theories explain exposure effects on liking as the result of increased fluency (Winkielman & Cacioppo, 2001; Winkielman et al., 2003) or reduced apprehension towards repeatedly-presented stimuli (Harrison, 1977; Zajonc, 1968; Zebrowitz & Zhang, 2012). In contrast, the present experiments demonstrated that exposure effects on emotional intensity and evaluative extremity are mediated, at least in part, by enhanced relative salience. Across experiments, I demonstrated that experimentally increasing exposure causes stimuli to become more salient (Experiments 1–3) and that experimentally increasing salience causes evaluations of stimuli to become more extreme and emotionally intense (Experiment 4). This supports the hypothesized causal chain in which exposure increases salience and salience makes evaluations more extreme. Additionally, statistical mediation models in Experiments 1 and 2 were consistent with the hypothesis that exposure may increase emotional intensity by increasing salience.

Across experiments, several tests were conducted to investigate the hypothesis that mere exposure effects on increased liking are mediated by salience. The results pertaining to this question were somewhat mixed. Statistical mediation models were consistent with the idea that salience might account for the effect of repeated exposure on increased liking (Experiments 1 and 2). However, only one of the two experiments that manipulated salience found that it increased liking. Specifically, the salience manipulation in Experiment 4 did not increase liking. In contrast, the manipulation in Experiment 3 which impacted salience (i.e., within-subjects vs. between-subjects design) suggested that exposure increases liking more when confounded with relative salience (i.e., within-subjects) than when exposure is isolated from relative salience (i.e.,

between-subjects). Future research should continue to investigate the variables that contribute to exposure effects and should add salience to the list of likely mediators.

Theoretical implications and connections to previous research

Salience may explain other mere exposure results. The idea that salience partially 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 to when stimulus presentation is homogeneous (Bornstein, 1989; Harrison & Crandall, 1972). In heterogeneous presentations, which are used in the vast majority of mere exposure research, 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 relative salience. The finding that exposure effects are larger in heterogeneous presentation experiments than in homogeneous presentation experiments is consistent with the idea that relative salience plays a role in these exposure effects.

The idea that salience contributes to exposure effects could also explain why, according to a few experiments, exposure makes evaluations of negative stimuli more negative (Kruglanski et al., 1996; Meskin et al., 2013). Exposure increases salience (Experiments 1–3) and salience makes evaluations more extreme (Experiment 4; Downing et al., 1992). Therefore, it is not surprising that salience makes evaluations more extreme. This finding, that exposure makes initially-negative evaluations more negative, poses a problem for many theories of the mere exposure effect (Harrison, 1977; Winkielman et al., 2003; Zajonc, 1968). For example, one influential account of mere exposure proposes that exposure influences evaluations by reducing

initial apprehension and uneasiness (which would imply that it would make evaluations of negative stimuli less negative; Harrison, 1977; Zajonc, 1968). Another influential theory proposes that exposure makes evaluations of all stimuli more positive because fluency is always experienced as a positive affective state (Winkielman & Cacioppo, 2001; Winkielman et al., 2003). In contrast, a salience account of exposure effects coheres with the observation that exposure makes negative evaluations more negative.

Hedonic adaptation. The results of the present experiments appear to conflict with research on hedonic adaptation and affective habituation (Dijksterhuis & Smith, 2002; Frederick & Loewenstein, 1999; Galak, Redden, Yang, & Kyung, 2014; Leventhal, Martin, Seals, Tapia, & Rehm, 2007; Yang & Galak, 2015). For example, in one series of hedonic adaptation experiments, repeated exposure to a photograph of a beach vacation reduced the amount of happiness and positive emotion that the image elicited (Yang & Galak, 2015). Most of these experiments on hedonic adaptation exposed participants to just one stimulus; in other words, presentation was homogeneous. A salience account could therefore explain why exposure did not increase liking (i.e., because it likely had little to no effect on relative salience). It is unclear whether a salience account could explain why exposure decreased liking in hedonic adaptation research, however. It is possible that the monotonous nature of viewing the same photograph repeatedly (without any other stimuli in the slideshow) increased boredom and task-unrelated thoughts, making the photograph less salient (Bornstein et al., 1990). Or it is possible that other elements of the experiment that differ from mere exposure research could explain hedonic adaptation.[8] In the future, researchers should investigate whether repeated exposure reduces

[8] Most of these hedonic adaptation experiments use stimuli that are initially very positive rather than neutral or mild (Dijksterhuis & Smith, 2002; Yang & Galak, 2015), and stimuli are often presented for over 5 seconds per each exposure rather than 1-2 seconds in mere exposure research (Yang & Galak, 2015). Additionally, the dependent

salience in these hedonic adaptation experiments, and whether reduced salience or other aspects of the procedure account for differences between hedonic adaptation results and mere exposure results.

The salience account of exposure effects may explain other findings in the hedonic adaptation literature. For example, one series of experiments demonstrated that repeated exposure to positive foods can increase liking, producing hedonic escalation rather than hedonic adaptation (Crolic & Janiszewski, 2016). In these experiments, participants were encouraged to attend to a different aspect of the food each time they viewed or consumed the food. Unlike participants in a control condition who viewed the same food repeatedly in the same way, attending to a different aspect of the food each time may have maintained attention and allowed the food to remain salient (Crolic & Janiszewski, 2016).

Models of salience. Many researchers across numerous fields of study have investigated determinants of salience in static visual scenes (Bundesen & Pedersen, 1983; Itti et al., 1998; Treisman & Gormican, 1988). For example, computational models have been designed to predict what aspects of a scene will be most salient and will capture attention (Itti et al., 1998). The present experiments investigated salience across time, showing that stimuli that are otherwise equivalent are more salient over the course of a slideshow if they were presented more frequently. Participants had little trouble making judgments of salience in a dynamic slideshow, indicating that images presented more frequently were much more salient. This research, along with a few previous studies which investigated salience dynamically (Abrams & Christ, 2003; Itti, 2005; Ouerhani & Hugli, 2003), broaden the scope of salience research and suggest that

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variable is slightly different, asking about how much happiness the photo provides "just now" (Yang, personal communication) rather than how much the participant likes the image in general. And participants are asked to complete the dependent variable multiple times for the same image, unlike in most mere exposure research. Any of these variables could account for the differences.

other variables that would have been ignored in a static scene (e.g., exposure frequency and motion onset) influence salience.

Evaluations are relative. One conclusion of the present research is that relative exposure matters more than absolute exposure (Experiment 3). When one group of participants was exposed to images nine times each and the other group was exposed to each image just once, differences in evaluations between the groups were small. However, when participants viewed some images nine times and others one time within the same slideshow, exposure had robust effects on evaluations.

Though previous research on mere exposure has not explicitly focused on relative exposure or salience, the general idea that relative differences matter more than absolute differences has been demonstrated in several other contexts. For example, emotional reactions are influenced more by relative comparisons (e.g., the actual outcome relative to expectations or other reference points) than by the absolute outcome itself. People have more intense positive emotional reactions when they win $5 unexpectedly (i.e., expecting to lose money or win less money) compared to when they win $9 expectedly (Mellers & McGraw, 2001; Mellers, Schwartz, Ho, & Ritov, 1997). Similarly, though silver medalists at the Olympics have a better objective outcome than bronze medalists, they display less happiness than bronze medalists, likely because they compare their outcome to the salient counterfactual of being a gold medalist whereas bronze medalists compare their outcome to the salient counterfactual of not winning any medal (Medvec, Madey, & Gilovich, 1995). Similarly, people indicate that earning a lower absolute salary that is higher than one’s peers is preferable to a higher absolute salary that is lower than peers’ salaries (Shafir, Diamond, & Tversky, 1997).

Relative comparisons also impact judgment and decision making more than absolute states (Hsee, 1996; Stewart, Brown, & Chater, 2005). For example, when deciding which of two poor individuals to donate money to, people more often decide to donate to someone who started with more money but then lost all of their money rather than someone who had no money to begin with (Small, 2010). Similarly, people evaluate life-saving policies relative to reference points such as the status quo or the total number of people affected. People choose to avoid losses relative to a neutral status quo (Tversky & Kahneman, 1981) and would rather save 225 out of 230 people affected by a disease rather than saving 230 out of 920 affected people (Bartels, 2006; Erlandsson, Björklund, & Bäckström, 2014; Västfjäll, Slovic, & Mayorga, 2015).

Evaluability. One reason why relative comparisons are more impactful than absolute states is that relative comparisons are easier to evaluate. For example, it is easy to quickly evaluate whether a dictionary with 30,000 entries or one with 20,000 entries is better, when they are presented side by side and equivalent on all other attributes (Hsee, 1996). However, when people are presented with just one dictionary and asked to evaluate how good that dictionary is, evaluations of dictionaries with 20,000 entries and those with 30,000 are evaluated very similarly, because people have no reference point from which to consider whether each it is good or bad.

Relative exposure might be more impactful than absolute exposure for this same reason. That is, it may be easy to evaluate the likability of stimuli and report higher liking for high exposure stimuli when the high and low exposure stimuli are presented in the same slideshow. In contrast, it may be more difficult to evaluate likability when there are no lower-exposure stimuli to compare the high-exposure stimuli to (i.e., in the between-subjects conditions of Experiment 3). This would be consistent with theorizing by Hsee. According to Hsee and colleagues,

absolute states are influential when they are evaluable, but in most cases relative factors are more influential than absolute states because they are more evaluable (Hsee, Yang, Li, & Chen, 2009).

Whether or not evaluability accounts for the larger effect of relative exposure (compared to absolute exposure), 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-subjects exposure manipulations should be just as effective as within-subjects manipulations (Moreland & Zajonc, 1976).

Clarifying questions for future research

The present experiments raise several questions that should be addressed in future research. It is important that future research examine the effects of exposure and salience in real world contexts such as during exposure to different marketing materials or peers in a classroom. In the present experiments, stimuli that were mundane and relatively homogeneous were used in order to maximize statistical power (McClelland, 2000) and make it easy to compare the results with previous mere exposure research (Montoya et al., 2017; Zajonc, 1968). However, these design elements also made it unclear whether the effects would generalize to stimuli that are more evocative or to contexts in which people have more previous experience. Additionally, it is possible that exposure effects would be smaller in heterogeneous environments, such as when people view both good and bad advertisements repeatedly. In the Pilot Study, positive and negative images were used and the different sets of stimuli were more heterogeneous, and no significant exposure effect was observed (see Supplemental Material). This may suggest that exposure effects are larger with mundane stimuli or in homogeneous contexts.

Implications

Bearing in mind that the effects of exposure may be smaller in everyday settings, the results still have implications for advertising, interpersonal relationships, and attitude polarization. The finding that repeated exposure makes evaluations more extreme (rather than universally more positive) implies that broadcasting an advertisement repeatedly is not always the optimal strategy that companies should use. Zajonc's theory of mere exposure effects implies that repeated advertising would improve evaluations of all advertisements (including negative ones), meaning that frequent advertising would always be an effective strategy. Contrary to this account, the results of the present experiments imply that if an advertisement is evaluated positively by nearly all viewers, playing it repeatedly could make viewers' evaluations more positive. However, if it is evaluated negatively by most viewers, repeated exposure could make evaluations of the advertisement more negative.

If relative salience (e.g., of a brand relative to competing brands) matters more than the absolute amount of exposure, and advertisers learn this fact, it could be problematic. With multiple advertisers competing to be most salient, this could create an escalation of advertising and eventually a tragedy of the commons whereby each company spends more money on advertising than they would like and consumers are confronted with far more advertisements than they could attend to or benefit from. Conversely, if relative salience matters most, it also implies that small doses of advertising could be surprisingly effective in contexts where one's competitors do not advertise.

In addition to these implications for advertising and consumer behavior, the results may have implications for interpersonal and intergroup relationships. Most previous research on mere exposure in interpersonal settings has theorized that repeated exposure breeds liking almost universally, including in the context of interpersonal attraction (Moreland & Beach, 1992) and

intergroup relations (Bornstein, 1993; Zebrowitz, White, & Wieneke, 2008; Zebrowitz & Zhang, 2012). However, the finding that repeated exposure makes evaluations more extreme suggests that initially-negative evaluations (e.g., toward another political party) may get more negative after repeated exposure.

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Appendix A: Stimuli

Turkish words (Experiments 1-4; Zajonc, 1968):

kadirga	enanwal	ikitaf	lokanta
biwojni	afworbu	zabulon	saricik
nansoma	jandara	dilikli	civadra

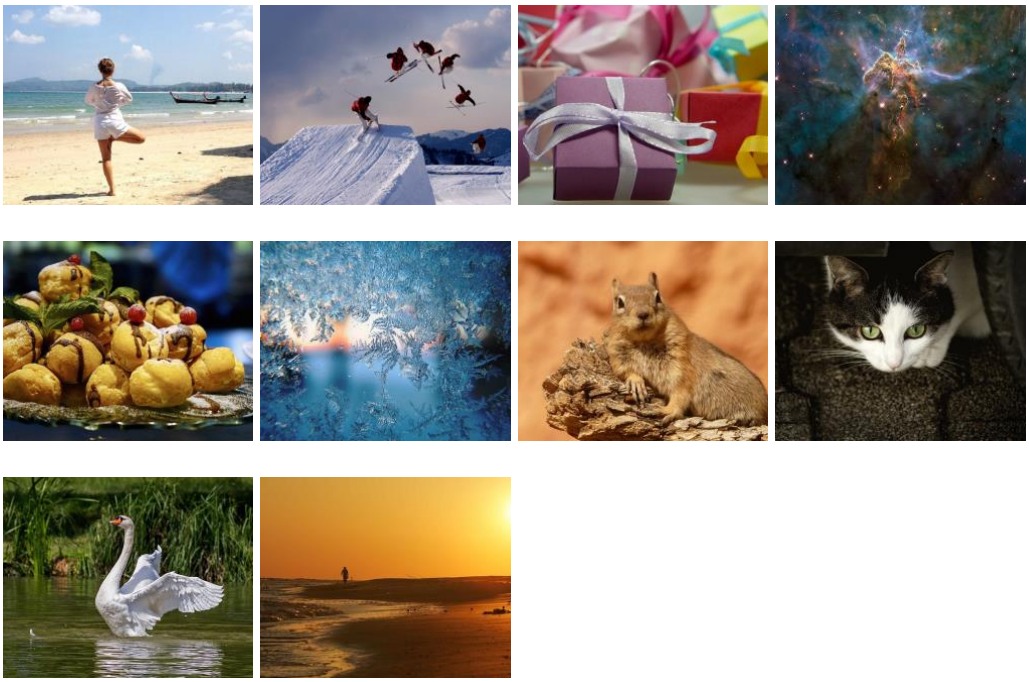
Portions of abstract painting (Experiments 1-4; Zajonc, Shaver, Tavris, & Van Kreveld, 1972):

Full painting (not used in experiments):

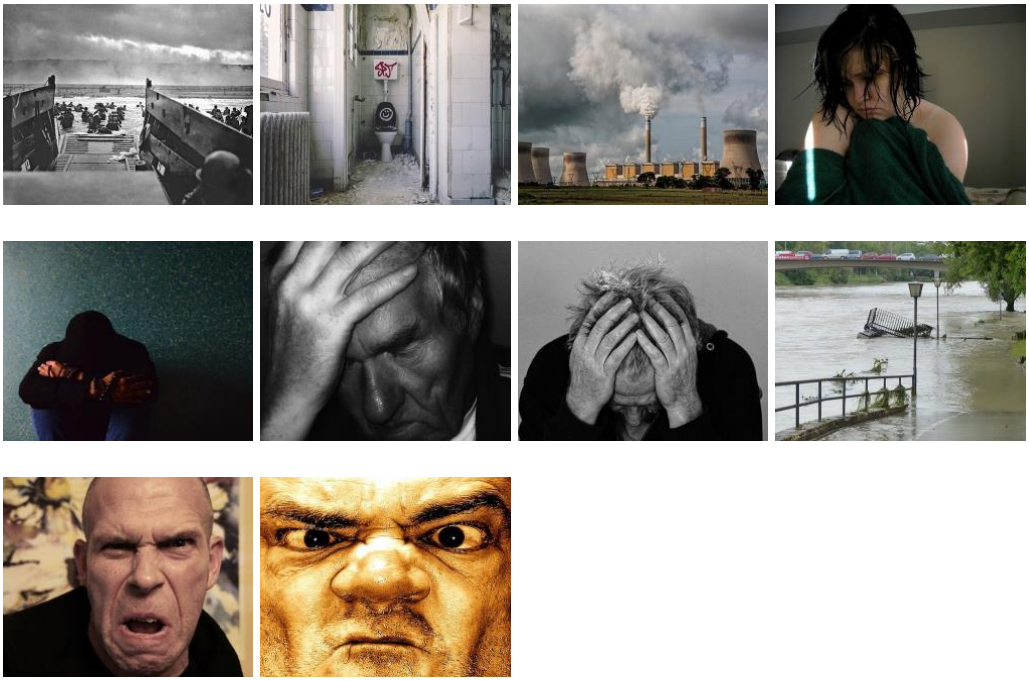
Chinese characters (Experiments 1-3; Murphy & Zajonc, 1993; Payne, Chung, Goverun, & Stewart, 2005; Zajonc, 1968):

车长册采才不
贝巴八连

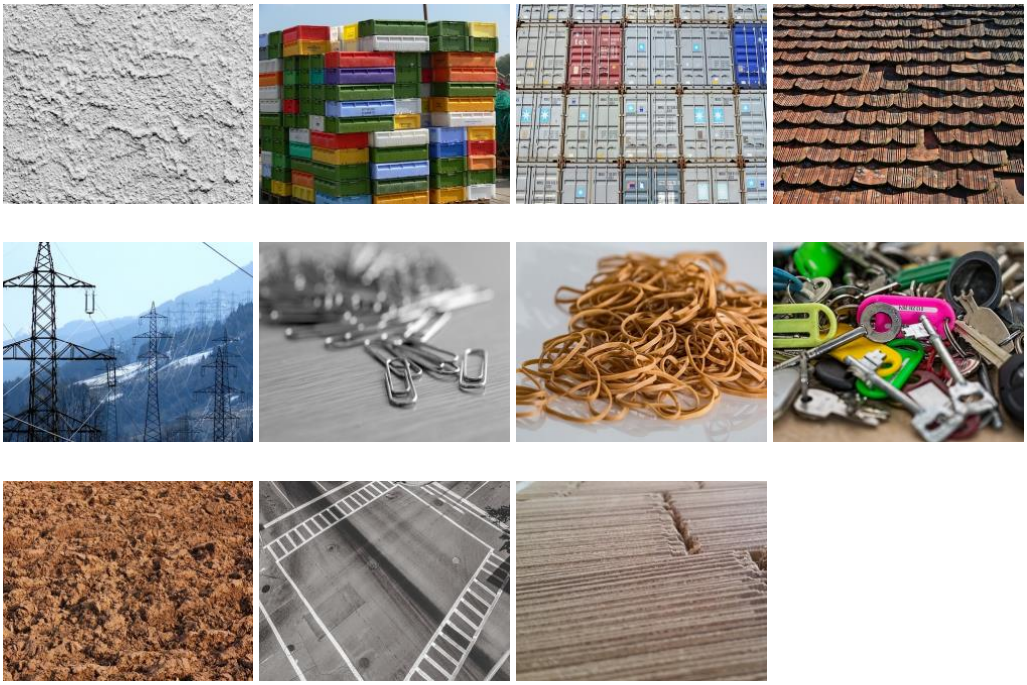
Positively-valenced images (Pilot Study; Kurdi, Lozano, & Banaji, 2017)



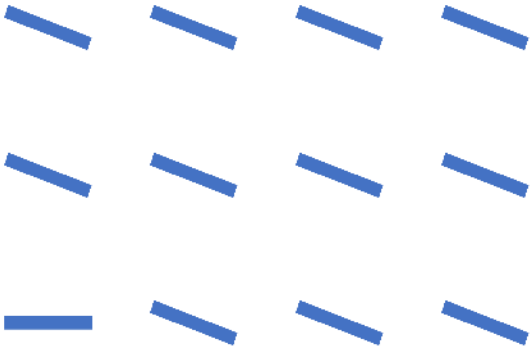
Negatively-valenced images (Pilot Study; Kurdi et al., 2017)



Neutral images (Pilot Study; Kurdi et al., 2017)



Line stimuli (Experiment 4; Treisman & Gelade, 1980)



Appendix B: Full Text of Cover Stories and Funnel Debriefing

Cover Story (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 to 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?

Funnel Debrief (Experiments 1–3).

1. What do you think was the research question that the experimenters were testing? (free response)
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 to shapes and symbols
    b. Whether people are better at remembering pictures presented a couple times compared to 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 require 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? (free response)

Experiment 4 Cover Story

- We are studying how people evaluate words, shapes, and images differently depending on features of the words, shapes, and images. For example, we will examine whether the number of vowels or consonants influence how much people like words, and whether the number of edges in a shape influence how much people like shapes.

Experiment 4 Funnel Debrief

1. What do you think was the research question that the experimenters were testing? (free response)
2. Which of the following do you think the researchers were studying? (multiple choice)
    a. Whether features of words, shapes, and images (e.g., the number of vowels in words or the number of edges in shapes) influence how much people like those words and shapes.
    b. Whether the size and font of shapes and words influence people's emotional reactions
    c. Whether people like things presented higher (e.g., at the top of a screen) more than things presented lower (e.g., at the bottom of a screen).
    d. Whether people like unfamiliar shapes and words (for example, foreign words) more than familiar shapes and words
    e. Whether people like words, shapes, and images that are salient more than ones that blend in
    f. Whether the color of words, symbols, and shapes influence whether they are perceived to be good or bad.
    g. Whether people have more negative emotional reactions and feel more uneasy when foreign words and unfamiliar shapes are presented
    h. How the amount of time people are exposed to images influences people's reactions and evaluations of those images.
3. Some words, shapes, and images were horizontal whereas others were rotated 20 degrees to the right. Do you have an idea why this was the case? Answer "Yes" or "No". If you indicate "Yes", please provide your idea about why some images were rotated while others were not (free response).

Appendix C: Full Text of Memory and Goodness of Meaning Measures

Goodness of Meaning Measure and Instructions (Experiments 1–4).

- Instructions: Some of the [characters/Turkish words] you saw in the previous slideshow correspond to something good. These might be adjectives like "fantastic", "sensational", "wonderful", or "favorite". Others depict something bad, such as "horrendous", "fail", or "disgraceful". Below, please make quick guesses about whether each character means something "good" or something "bad"
- Item wording: For each [character/word], indicate the extent to which you think it means something good or bad. 0 (very bad) to 6 (very good).
- *Note*. Measure and instructions follow Zajonc (1968). Across all experiments, this item was only included for the Chinese characters and Turkish words. It would be nonsensical for the other stimulus sets. Therefore, in each experiment, the liking DV is an average of two items (liking and goodness of meaning) for the Chinese characters and Turkish words stimuli and one item (liking only) for other stimuli.

Memory Measure and Instructions (Experiments 1–3).

- Instructions: The last portion of this study is the key **memory test**. Which of the below images, words, and characters did you see **in the slideshows** earlier? You viewed 3 slideshows during the study; indicate which images, words, and characters were presented in at least one of the slideshows you saw. (If you rated an option during the survey but did not see it in the slideshow, do not select that option.)

Appendix D: Model Comparisons Testing Multiple Mediators Individually in Experiments 1-3

Table D1.
Testing multiple potential mediators of the effect of exposure on emotional intensity in Experiment 1.

	Salience only	Fluency only	Uneasy only	Fluency & uneasy	All three variables
c: the effect of exposure on emotional intensity)	0.21				
c^1 : the effect of exposure when controlling for each variable(s)	0.02	0.20	0.20	0.19	0.01
c minus c^1 (statistically equivalent to indirect effect)	0.19	0.01	0.01	0.02	0.20

Note. Unlike the mediation models in the main text, these mediation models were conducted for each variable (or multiple variables in a column) independently. So this is not a multiple mediation analysis. The effect "c" is the effect of exposure on emotional intensity without any covariates or potential mediators in the model.

Table D2.
Testing multiple potential mediators of the effect of exposure on evaluative extremity in Experiment 1.

	Salience only	Fluency only	Uneasy only	Fluency & uneasy	All three variables
c: the effect of exposure on evaluative extremity	0.03				
c^1 : the effect of exposure when controlling for each variable(s)	0.00	0.03	0.02	0.02	0.00
c minus c^1 (statistically equivalent to indirect effect)	0.03	0.00	0.01	0.01	0.03

Table D3.
Testing multiple potential mediators of the effect of exposure on liking in Experiment 1.

	Salience only	Fluency only	Uneasy only	Fluency, uneasy & familiarity	All four variables
c: the effect of exposure on liking	0.03				
c^1 : the effect of exposure when controlling for each variable(s)	–0.04	0.02	0.04	0.03	–0.03
c minus c^1 (statistically equivalent to indirect effect)	0.07	0.01	–0.01	0.00	0.06

Note. The effect "c" is the effect of exposure on liking without any covariates or potential mediators in the model. Unlike in the other models, "c" on liking was not significantly larger than zero. However, it can be useful to estimate indirect effects even in the absence of a significant "c"effect (Shrout & Bolger, 2002).

Table D4.
Testing multiple potential mediators of the effect of exposure on emotional intensity in Experiment 2.

	Salience only	Fluency only	Uneasy only	Fluency, uneasy & familiarity	All four variables
c: the effect of exposure on emotional intensity)	0.39				
c^1 : the effect of exposure when controlling for each variable(s)	0.09	0.37	0.41	0.24	0.04
c minus c^1 (statistically equivalent to indirect effect)	0.30	0.02	–0.02	0.15	0.35

Note. The effect "c" is the effect of exposure on emotional intensity without any covariates or potential mediators in the model. The familiarity item was not present in Experiment 1, but was present in Experiment 2, so was tested here.

Table D5.
Testing multiple potential mediators of the effect of exposure on evaluative extremity in Experiment 2.

	Salience only	Fluency only	Uneasy only	Fluency, uneasy & familiarity	All four variables
c: the effect of exposure on evaluative extremity	0.08				
c^1 : the effect of exposure when controlling for each variable(s)	0.05	0.08	0.08	0.04	0.03
c minus c^1 (statistically equivalent to indirect effect)	0.03	0.00	0.00	0.04	0.05

Table D6.
Testing multiple potential mediators of the effect of exposure on liking in Experiment 2.

	Salience only	Fluency only	Uneasy only	Fluency, uneasy & familiarity	All four variables
c: the effect of exposure on liking	0.26				
c^1 : the effect of exposure when controlling for each variable(s)	0.15	0.21	0.23	0.10	0.05
c minus c^1 (statistically equivalent to indirect effect)	0.11	0.05	0.03	0.16	0.21

Appendix E: Results of Mixed Effects Models: Experiments 1-4

Table E1.
Results of a linear mixed model estimating emotional intensity in Experiment 1.

Fixed effects	***b***	***SE(b)***	***t***	***p***
Intercept	3.49	0.19	18.67	< .001
Exposure (–1.5 = 0 exposures, –.5 = 1 exposure, .5 = 3 exposures, 1.5 = 9 exposures)	0.20	0.04	4.88	< .001
Exposure Contrast 2 (.5 = 0 exposures, –.5 = 1 exposure, –.5 = 3 exposures, .5 = 9 exposures)	–0.04	0.09	–0.45	.657
Exposure Contrast 3 (–.5 = 0 exposures, 1.5 = 1 exposure, –1.5 = 3 exposures, .5 = 9 exposures)	0.03	0.03	1.13	.261
Target (.5 = target, –.5 = non-target)	0.58	0.05	11.43	< .001

Random effects	***Variance***	***SD***
Participant (intercept)	3.25	1.80
Participant (slope of Exposure)	0.05	0.22
Participant (slope, Exposure Contrast 2)	0.01	0.10
Participant (slope, Exposure Contrast 3)	0.00	0.03
Stimulus (intercept)	0.03	0.19
Stimulus (slope of Exposure)	0.01	0.10
Stimulus (slope, Exposure Contrast 2)	0.11	0.34
Stimulus (slope, Exposure Contrast 3)	0.00	0.04

Note. Contrast codes are provided in parentheses. Participant and stimulus were included as random factors, and the random intercepts and all possible random slopes were included (Barr et al., 2013). The first contrast ("Exposure") is the key contrast that I hypothesized would influence each DV; the latter two contrasts are simply included to make the model orthogonal. The model would not converge with additional random slopes for Target, so those were removed.

Table E2.

Results of a linear mixed model estimating evaluative extremity (i.e., deviation from the neutral midpoint of the liking scale) in Experiment 1.

Fixed effects	***b***	***SE(b)***	***t***	***p***
Intercept	1.04	0.06	17.78	< .001
Exposure (–1.5 = 0 exposures, –.5 = 1 exposure, .5 = 3 exposures, 1.5 = 9 exposures)	0.03	0.01	2.09	.044
Exposure Contrast 2 (.5 = 0 exposures, –.5 = 1 exposure, –.5 = 3 exposures, .5 = 9 exposures)	0.02	0.03	0.56	.581
Exposure Contrast 3 (–.5 = 0 exposures, 1.5 = 1 exposure, –1.5 = 3 exposures, .5 = 9 exposures)	0.00	0.01	–0.20	.840
Target (.5 = target, –.5 = non-target)	0.06	0.02	2.86	.004

Random effects	***Variance***	***SD***
Participant (intercept)	0.29	0.54
Participant (slope of Exposure)	0.00	0.00
Participant (slope, Exposure Contrast 2)	0.00	0.01
Participant (slope, Exposure Contrast 3)	0.00	0.01
Stimulus (intercept)	0.01	0.08
Stimulus (slope of Exposure)	0.00	0.02
Stimulus (slope, Exposure Contrast 2)	0.00	0.05
Stimulus (slope, Exposure Contrast 3)	0.00	0.00

Table E3.

Results of a linear mixed model estimating liking in Experiment 1.

Fixed effects	***b***	***SE(b)***	***t***	***p***

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	1.19	.243
Exposure Contrast 2 (.5 = 0 exposures, –.5 = 1 exposure, –.5 = 3 exposures, .5 = 9 exposures)	0.02	0.05	0.52	.604
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 = non-target)	0.33	0.03	9.59	< .001

Random effects	***Variance***	***SD***
Participant (intercept)	0.27	0.52
Participant (slope of Exposure)	0.01	0.09
Participant (slope, Exposure Contrast 2)	0.01	0.11
Participant (slope, Exposure Contrast 3)	0.00	0.04
Stimulus (intercept)	0.04	0.19
Stimulus (slope of Exposure)	0.00	0.04
Stimulus (slope, Exposure Contrast 2)	0.00	0.07
Stimulus (slope, Exposure Contrast 3)	0.00	0.01

Table E4.

Results of a linear mixed model estimating emotional intensity in Experiment 2.

Fixed effects	***b***	***SE(b)***	***t***	***p***
Intercept	3.13	0.19	18.37	< .001
Exposure (–1.5 = 0 exposures, –.5 = 1 exposure, .5 = 3 exposures, 1.5 = 9 exposures)	0.39	0.06	6.13	< .001

Exposure Contrast 2 (.5 = 0 exposures, –.5 = 1 exposure, –.5 = 3 exposures, .5 = 9 exposures)	0.17	0.08	2.00	.053

Random effects	***Variance***	***SD***
Participant (intercept)	2.87	1.69
Participant (slope of Exposure)	0.20	0.45
Participant (slope, Exposure Contrast 2)	0.08	0.29
Stimulus (intercept)	0.17	0.42
Stimulus (slope of Exposure)	0.02	0.14
Stimulus (slope, Exposure Contrast 2)	0.04	0.20

Note. Contrast codes are provided in parentheses. Participant and stimulus were included as random effects, and both the random intercepts and all possible random slopes were included (Barr et al., 2013). The first contrast ("Exposure") is the key contrast that I hypothesized would influence each DV; the second contrast is simply included to make the model orthogonal.

Table E5.
Results of a linear mixed model estimating evaluative extremity in Experiment 2.

Fixed effects	***b***	***SE(b)***	***t***	***p***
Intercept	1.10	0.05	23.18	< .001
Exposure (–1.5 = 0 exposures, –.5 = 1 exposure, .5 = 3 exposures, 1.5 = 9 exposures)	0.09	0.03	3.42	.002
Exposure Contrast 2 (.5 = 0 exposures, –.5 = 1 exposure, –.5 = 3 exposures, .5 = 9 exposures)	0.04	0.04	1.04	.298

Random effects	***Variance***	***SD***
Participant (intercept)	0.21	0.46
Participant (slope of Exposure)	0.01	0.08
Participant (slope, Exposure Contrast 2)	0.00	0.06
Stimulus (intercept)	0.01	0.10
Stimulus (slope of Exposure)	0.01	0.08

Stimulus (slope, Exposure Contrast 2)	0.00	0.03

Table E6.
Results of a linear mixed model estimating liking in Experiment 2.

Fixed effects	***b***	***SE(b)***	***t***	***p***
Intercept	0.30	0.09	3.53	< .001
Exposure (–1.5 = 0 exposures, –.5 = 1 exposure, .5 = 3 exposures, 1.5 = 9 exposures)	0.26	0.04	6.50	< .001
Exposure Contrast 2 (.5 = 0 exposures, –.5 = 1 exposure, –.5 = 3 exposures, .5 = 9 exposures)	0.03	0.07	0.48	.636

Random effects	***Variance***	***SD***
Participant (intercept)	0.27	0.52
Participant (slope of Exposure)	0.06	0.24
Participant (slope, Exposure Contrast 2)	0.01	0.11
Stimulus (intercept)	0.10	0.31

Table E7.
Results of a linear mixed model estimating emotional intensity in Experiment 4.

Fixed effect	***b***	***SE(b)***	***t***	***p***
Intercept	2.46	0.19	13.25	< .001
Salient (–1 = rotated at same angle as 10 other stimuli, 1 = different rotation)	0.91	0.18	5.01	< .001

Random effects	***Variance***	***SD***
Participant (intercept)	1.95	1.40
Participant (slope of Salient)	0.51	0.72
Stimulus (intercept)	0.11	0.33
Stimulus (slope of Salient)	0.38	0.62

Note. Contrast codes are provided in parentheses. Participant and Stimulus were included as random effects, and both the random intercepts and all possible random slopes were included (Barr et al., 2013).

Table E8.
Results of a linear mixed model estimating evaluative extremity in Experiment 4.

Fixed effect	***b***	***SE(b)***	***t***	***p***
Intercept	1.08	0.07	14.48	< .001
Salient (–1 = rotated at same angle as 10 other stimuli, 1 = different rotation)	0.43	0.09	4.90	< .001

Random effects	***Variance***	***SD***
Participant (intercept)	0.27	0.52
Participant (slope of Salient)	0.18	0.42
Stimulus (intercept)	0.03	0.17
Stimulus (slope of Salient)	0.04	0.20

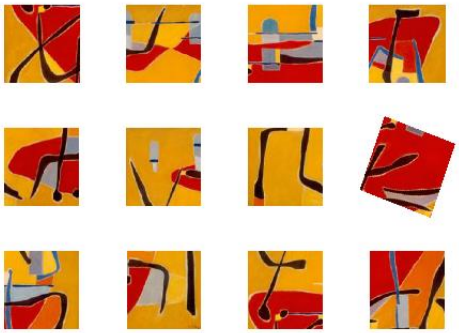
Table E9.
Results of a linear mixed model estimating liking in Experiment 4.

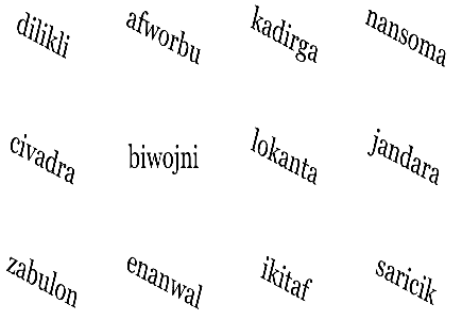
Fixed effect	***b***	***SE(b)***	***t***	***p***
Intercept	0.25	0.08	3.02	.004
Salient (–1 = rotated at same angle as 10 other stimuli, 1 = different rotation)	0.01	0.14	0.10	.925

Random effects	***Variance***	***SD***
Participant (intercept)	0.31	0.55
Participant (slope of Salient)	0.65	0.81
Stimulus (intercept)	0.03	0.16
Stimulus (slope of Salient)	0.06	0.24

Appendix F: Stimulus Presentation of One Salient and Eleven Other Stimuli (Experiment 4).

Screenshots of stimulus presentation in Experiment 4. The top image depicts one diagonal stimulus which is salient in the context of eleven horizontally-oriented stimuli. The bottom image depicts one horizontally-oriented stimulus, which is salient in the context of eleven diagonally-oriented stimuli.





Supplemental Material

Pilot Study: Failed Replication of the Mere Exposure Effect

Prior to Experiment 1, I conducted a Pilot Study designed simply to replicate the mere exposure effect (Zajonc, 1968). I wanted to first ensure that I could replicate the effect before examining effects of exposure on other variables or adding a moderator (i.e., within-subjects vs. between-subjects design). However, I was unable to replicate the mere exposure effect in the Pilot Study. In the Discussion section below, I discuss two likely reasons for the failed replication and adjustments that were made prior to all experiments reported in the main text.

Method

Eighty-five participants from Amazon Mechanical Turk participated in exchange for $1.00. The procedure was similar to Experiment 1 except for two major differences. First, there were six sets of stimuli (rather than three sets) that participants viewed and rated (in six counterbalanced blocks). These stimulus sets included Chinese characters, Turkish words, segments of the abstract art painting, as well as positively-valenced images, negatively-valenced images, and neutral images from the OASIS database of normed images (Kurdi et al., 2017; see Appendix A). Second, participants viewed and rated only two stimuli from each set in the slideshow. One stimulus was presented two times and the other was presented ten times in the slideshow for 1.0 seconds each time, separated by a 1.0 second fixation cross. After viewing these two stimuli, participants rated how much they liked each image and how salient each image was, but they did not complete the other dependent measures that were included in Experiment 1.

Results

Exposure did not significantly increase how much participants liked the stimuli. Specifically, participants on average rated stimuli similarly in liking whether they were presented

ten times (M = 4.02, SD = 1.77) or two times (M = 3.89, SD = 1.80), t = 1.24, p = .202. Analyzing each set of images individually, there was no significant effect of exposure on liking ratings of any set. Exposure had a marginal positive effect on how much participants liked the segments of the abstract art painting, t = 1.67, p = .094, but no effect on any of the other five sets (all $|t|$s < 1, all ps > .25). Exposure did increase salience such that stimuli presented 10 times were rated more salient (M = 4.46, SD = 1.89) than stimuli presented 2 times (M = 3.79, SD = 1.96), t = 4.29, p < .001.

Discussion

There were two differences between our Pilot Study and previous mere exposure experiments, which I concluded must be responsible for the failed replication. One difference was that I used six sets of stimuli, including one set of more positively-valenced stimuli and one set of more negatively-valenced stimuli than is typically used in mere exposure research. This between-set variance may have dwarfed any within-set variance between stimuli (see Krueger, 1992; Bless & Schwarz, 2010).

The other difference between our Pilot Study and previous mere exposure research was that I included only two stimuli in each slideshow, rather than the six or more typically used in mere exposure research. Previous research suggests that mere exposure effects are reduced or eliminated when participants become bored (Bornstein et al., 1990), which may have happened given that I presented only two different stimuli in each slideshow in the Pilot. In all subsequent experiments, I used only sets of neutral stimuli, to reduce the variance between sets of stimuli. Additionally, I presented more stimuli within each slideshow to more closely replicate previous research and reduce boredom for participants.

The Pilot Study also suggests that salience is likely not the only factor that influences how much people like stimuli in mere exposure experiments. In this Pilot Study, exposure may have increased salience while also increasing boredom, and salience and boredom may have opposite effects on liking (with boredom reducing or reversing mere exposure effects; Bornstein et al., 1990).

Supplemental Analyses: Experiment 1

Several supplemental analyses were conducted to test the robustness of the effects. First, I tested the effect of exposure on evaluative extremity and emotional intensity when controlling for the two covariates--fluency and uneasiness. The effects on both evaluative extremity, $t(27.90) = 1.97$, $b = 0.02$, $p = .058$, and emotional intensity, $t(29.70) = 4.90$, $b = 0.19$, $p < .001$, remained similar in size when controlling for these covariates.

Additionally, I tested whether the effects of exposure on evaluative extremity remained when controlling for emotional intensity. The effect on extremity remained significant when controlling for emotional intensity, $t(24.20) = 2.24$, $b = 0.06$, $p = .035$.

I also repeated the models estimating evaluative extremity and emotional intensity when removing the three participants who could comprehend Mandarin characters (zero could speak or comprehend Turkish). When removing these three participants, the effects of exposure on emotional intensity, $t(29.08) = 5.46$, $b = 0.21$, $p < .001$, and evaluative extremity, $t(35.80) = 1.99$, $b = 0.02$, $p = .054$, remained similar in size. I also examined participants' responses to the funnel debriefing questions. In Experiment 1, none of the participants correctly guessed the research question from the list of multiple-choice options.

Alternative measure of evaluative extremity.

In addition to the more common midpoint deviation measure of evaluative extremity, I also computed for each participant and set of images a measure of extremity relative to the other images in that set (rated by that person). This measure was highly correlated with the midpoint deviation extremity measure (r = .67) and had a weak positive correlation with emotional intensity (r = .26). Repeated exposure had a marginal effect on this measure of evaluative extremity, $t(24.86) = 1.85$, $b = 0.01$, $p = .076$.

Supplemental Analyses: Experiment 2

A number of supplemental analyses were conducted to test the robustness of the exposure effects on evaluative extremity, emotional intensity, and liking. First, I tested the effect of exposure on each of these dependent variables when controlling for the three covariates--fluency, familiarity, and uneasiness. The effects on evaluative extremity, $t(26.90) = 1.41$, $b = 0.04$, $p = .171$, emotional intensity, $t(58.60) = 4.38$, $b = 0.24$, $p < .001$, and increased liking $t(108.60) = 3.21$, $b = 0.10$, $p = .002$, each remained similar in size (and the latter two remained statistically significant) when controlling for these covariates. The effects of exposure on fluency and uneasiness are reported in the main text. There was also an effect of exposure on increased perceived familiarity, $t(100.45) = 7.15$, $b = 0.67$, $p < .001$.

I also repeated the models estimating evaluative extremity, liking, and emotional intensity when removing the one participant who could comprehend Mandarin characters and the one participant who could comprehend Turkish words. When removing these two participants, the effects of exposure on evaluative extremity, emotional intensity, and liking remained significant (all ts > 2, all ps < .05). Finally, I repeated the models while excluding the participants who reported they had seen some of the images in the experiment before (given that some researchers have argued it is necessary to use novel images in mere exposure experiments;

Harrison, 1977). Even when excluding these individuals, the effects of exposure on evaluative extremity, emotional intensity, and liking remained significant (all *t*s > 2, all *p*s < .05)

Alternative measure of evaluative extremity

As in Experiment 1, I also computed a measure of the extent to which each rating a given person makes deviates from that person's average rating of the stimuli in the set. This was intended as a second measure of evaluative extremity, and it was highly correlated with the primary extremity measure (i.e., midpoint deviation), $r = .57$. This item was weakly correlated with emotional intensity, $r = .13$. Repeated exposure increased deviation from each participant's average rating of the other stimuli in the set, $t(210.30) = 2.09$, $b = 0.03$, $p = .037$.

Supplemental Analyses: Experiment 4

As in the previous experiments, I tested whether the effect of salience on evaluative extremity remained when controlling for emotional intensity. The effect on evaluative extremity did remain significant, $t(67.80) = 3.66$, $b = 0.31$, $p < .001$, providing further support that these two effects were not redundant with one another.

Alternative measure of evaluative extremity

I also constructed a second measure of evaluative extremity by computing the extent to which each rating a person made deviated from that person's average rating of the stimuli in the set. This was intended as a secondary measure of evaluative extremity, and it was highly correlated with the primary extremity measure (i.e., midpoint deviation), $r = .62$. This item was weakly correlated with emotional intensity, $r = .28$. The salience manipulation increased deviation from each participant's average rating of the other stimuli in the set, $t(68.76) = 4.54$, $b = 0.55$, $p < .001$.

E**xploratory analyses**

Effects of diagonal versus horizontal orientation. I hypothesized that orientation contrast (i.e., the salience manipulation) would influence evaluations and emotional intensity. However, I did not hypothesize that the absolute orientation would influence these evaluations. In other words, I did not anticipate that the eleven diagonal stimuli would be rated differently (among those who saw eleven diagonal stimuli) than the eleven horizontal stimuli (among those who saw eleven horizontal stimuli). Nevertheless, exploratory analyses were conducted to look for differences depending on orientation. There was no significant effect of orientation on any of the key dependent variables: evaluative extremity, emotional intensity, or liking.

Salience x diagonal salient condition interaction. As described in the main text, half of the participants were randomly assigned to see eleven diagonal stimuli in each set and the twelfth was oriented horizontally (i.e., horizontal salient condition). The other half saw eleven horizontally-oriented stimuli and the twelfth was oriented diagonally (i.e., diagonal salient condition). Though I did not hypothesize any difference in the size of the salience effect depending on the orientation of the salient stimulus, I conducted a set of additional exploratory analyses investigating interactions. There was no significant salience x diagonal salient interaction for any of the key dependent variables--evaluative extremity, emotional intensity, or liking (all $|t|$s < 1.42, all ps $> .16$).