Journal of Experimental Psychology: General
2017, Vol. 146, No. 7, 924–942

0096-3445/17/$12.00 http://dx.doi.org/10.1037/xge0000291

Dissociating Affective and Semantic Valence

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We examined the possible dissociation between two modes of valence: affective valence (valence of e emotional response) and semantic valence (stored knowledge about valence of an object or event). In Experiment 1, 50 participants viewed affective pictures that were repeatedly presented while their facial electromyography (EMG) activation and heart rate response were continuously recorded. Half of the participants provided self-report ratings about the valence of their feelings and half about the valence of the stimulus. Next, all participants performed an affective Simon task. In Experiment 2, 30 new participants performed the affective Simon task with the repeated exposure embedded within the task. The results showed that measures related to affective valence (feelings-focused self-reports, heart rate, and facial EMG activations) attenuated with repeated exposure to pleasant and unpleasant pictures, whereas measures related to semantic valence (knowledge-focused self-reports and congruency effect of affective Simon task) did not. These findings strongly suggest that affective and semantic valence represent two distinct psychological constructs.

Keywords: valence, emotional response, affective Simon, habituation, repeated exposure

Supplemental materials: http://dx.doi.org/10.1037/xge0000291.supp

Aristippus and Socrates were watching a TV program when a tragic car accident was graphically reported. Aristippus responded fearfully, experiencing a series of emotional changes, autonomic activation, and multiple facial expressions—all comprising an alert system that codes the occurrence of negative events. Socrates watched the report and only said to himself "this is terrible," with no emotional response at all. Aristippus' response was obviously emotional. Socrates, on the other hand, knew that car accidents are negative events that can results in loss of lives (therefore noting that a terrible incident had occurred); however, this knowledge was not accompanied by any changed feelings, autonomic activation, facial expressions, or other emotional reactions.

The behaviors displayed by Aristippus and Socrates exemplify two potentially distinct modes of valence that represent positive and negative value of events: The first is valence of emotional response (henceforth affective valence), and the second is stored semantic knowledge about the valence of an event or object (henceforth semantic valence). The dissociation between affective valence and semantic valence can clearly be seen as adaptive, enabling humans to evaluate stimuli as appetitive and worth approaching or as aversive and worthy of avoidance without reactivity. For example, parents can teach their children to avoid eating unwashed fruit (or to wash fruit before eating) without the need to actually experience a full-blown emotional reaction. Imagine if the simple act of explaining the importance of washing an apple to a child was permanently accompanied by the parent's accelerated heart rate, increased sweat, and the emotional experience of fear of intoxication.

Although emotion literature implicitly and explicitly uses similar distinctions, the dissociation between affective and semantic valence remains an open question. Do they represent distinct mental phenomena? Do they obey different rules? Can affective and semantic valence be empirically dissociated? Can participants distinguish between the two and report on them separately? Is there a way to determine whether a given task or measure is more indicative of affective or semantic valence? These research questions can potentially contribute to emotion theory and research from two complementary perspectives.

First, the potential dissociation between affective and semantic modes of valence is fundamental to understanding the structure of human valence system. To date, measures that reflect positivity and negativity are usually placed under the same conceptual umbrella (e.g., "valence," "affective," "emotional"), with minimal distinction between the modes of valence they reflect. The present work suggests that what might seem to reflect a unitary structure of valence is likely to have at least two different, confounding underlying sources, affective and semantic, that are fundamentally distinct, dissociable and obey different, recognizable rules. Second, this work promotes an evidence-based taxonomic approach to

This article was published Online First April 17, 2017.

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Part of this work was presented at scientific conferences, including the sixth International Conference on Emotions, Well-being and Health (2015), Tilburg, the Netherlands, Animal and Human Emotions, Erice, Sicily (2016), and third Conference on Cognition Research of the Israeli Society for Cognitive Psychology, Akko, Israel (2016).

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the description of structure of emotion; that is, that taxonomy should be justified by strong empirical evidence.

Thus, the aim of the current study is to empirically investigate the possible dissociation between affective valence—the valence of emotional response and semantic valence—stored semantic knowledge about valence.

Working Definitions

Affective Valence: Valence of Emotional Response

Emotion can be described in dimensional terms as a state that is comprised of valence; that is, indexing the occurrence of an event as either pleasant or unpleasant (e.g., Dolan, 2002), with arousal being a secondary dimension (e.g., Russell, 1980, 2003, but see Kron, Goldstein, Lee, Gardhouse, & Anderson, 2013). This working definition is minimal and emphasizes valence dimension (i.e., pleasant or unpleasant) and object-relatedness (i.e., the occurrence of an event) as the two crucial characteristics of emotion (Barrett, 2006; Beedie, Terry, & Lane, 2005). Traditionally, certain measures of emotional response are more closely associated with the valence dimension (i.e., can distinguish between positive and negative emotional states), and others are associated more with arousal (i.e., can distinguish between emotionally positive and emotionally negative vs. neutral or nonemotional states). For example, the initial change in heartbeat intervals in response to emotional stimuli and activation of the corrugator muscle above the eyebrow are associated more with valence than with arousal, while electrodermal activity is associated more with the arousal dimension than with valence (e.g., Kron et al., 2013; Lang, Greenwald, Bradley, & Hamm, 1993).

Semantic Valence: Stored Semantic Knowledge About the Valence of an Event

Valence-related terms such as "positive" and "negative" or "pleasant" and "unpleasant" describe not only the changes that constitute the emotional response but can also be attributed to stored knowledge about the valence of objects and events. Compatible with the taxonomy of episodic and semantic memory (e.g., Schacter, Wagner, & Buckner, 2000; Tulving, 1984, 1993; Wheeler, Stuss, & Tulving, 1997), knowledge related to the valence of an event or an object can refer to a specific episode at a particular time and place (i.e., episodic knowledge), or alternatively, can represent general conceptual knowledge (semantic knowledge; Robinson & Clore, 2002b). For example, John's episodic memory has stored information about encountering a snake outside the warehouse last Saturday (e.g., the snake's elegant, swift movements in the grass and the surprise and fear that he felt). Contrary to episodic information, semantic knowledge enables storing general information about snakes (e.g., snakes can be venomous), including general assumption about how encountering a snake can influence one's emotion (e.g., should elicit fear and hence is not desirable; Robinson & Clore, 2002a). The current study focuses on semantic knowledge of the valence of an object or event.

In the example we presented previously, we stated that Socrates knows that car accidents are negative. He knows this because the concept "car accident" stored in his semantic memory represents information about the emotional valence of these events. When we say that Aristippus affective state changed following the TV report, we are describing an emotional response, a change in feelings of pleasure and displeasure, physiological reactions, and so forth, directed at an event (car accident). Thus, the distinction proposed here is between a mode of valence that is a dimension of an emotional reaction or a change in response to a specific object or event (and therefore temporally sensitive by definition), as opposed to a mode of semantic knowledge. which stores general, nonspecific, and relatively static information about the valence of a category of objects or events.

Variations of the distinction between semantic and affective valence and proxies to this distinction can be found in the taxonomy of many models of emotion, including cold versus hot emotional processes (Schaefer et al., 2003), cognitive appraisal versus feeling (Lazarus & Smith, 1988; Roseman & Smith, 2001), core affect versus affective quality (Russell, 2003), and evaluative versus signal learning (Baeyens, Eelen, Crombez, & Van den Bergh, 1992). Particularly relevant to this proposal is the distinction between experiential and nonexperiential components of self-reports described by Robinson and Clore (2002a, 2002b). The term "affective valence" used here includes what Robinson and Clore referred to as "experiential knowledge," but also includes other emotional components such as autonomic response and facial expressions. Yet, we address the nonexperiential component from a different perspective: While Robinson and Clore's nonexperiential component includes memories about specific situations in the past and beliefs about one's own feelings, the focus of the current study is on the semantic knowledge about the valence of objects and events. In addition, while the aim of Robinson and Clore is to uncover the nature of self-reports, our goal is to map the structure of human valence system and to develop a paradigm that distinguishes between affective and semantic valence in both implicit and physiological measures besides self-reports.

A similar distinction between affective and semantic valence is also prevalent in the attitude literature. Valence is a pivotal concept in attitude theory and serves as a common denominator of almost all various definitions of attitudes (e.g., Olson & Zanna, 1993) and its measures (Gawronski & Bodenhausen, 2011), which are usually assumed to involve/reflect the tendency of human mind to evaluate an object or event on the dimension of valence, that is, as good–bad, harmful–beneficial, pleasant–unpleasant, and likable–dislikable (Eagly & Chaiken, 1993). In addition to the centrality of valence, some of the main ideas and distinctions in the attitude theory show at least partial overlap with the distinctions between the affective and semantic aspects of valence. Some models of attitudes can be interpreted as emphasizing the semantic representation of valence, treating attitudes as information stored in long term memory (e.g., Fazio, Jackson, Dunton, & Williams, 1995). This, in turn, leads to research questions that emphasize semantic aspects of valence, such as the effect of accessibility—that is, the strength of association between object and evaluation within long term memory (Fazio, 1990), the role of metacognition in changing stored information about object's valence (Petty, 2006) or the structure of the representation of attitudes in long term memory (e.g., Conrey & Smith, 2007). On the other hand, other models emphasize aspects related to affective valence as they use terms such as "feelings about," or "action tendency toward" in their definition of attitudes (Ajzen & Fishbein, 1975; Cacioppo &

Berntson, 1994). This in turn lead to research questions that emphasize affective aspects of valence, such as relation between negative and positive evaluations in the different stages of the emotional response (Cacioppo & Berntson, 1999). Moreover, some closely related variations of the distinction between affective and semantic modes of valence are also addressed explicitly in various theoretical moves, for example, treating attitudes as affective responses based upon the favorability of cognitive beliefs (Ajzen & Fishbein, 1975), the Associative–Propositional Evaluation (APE) Model that suggests distinction between "affective gut reaction" to "propositional belief" (Gawronski & Bodenhausen, 2011), or the distinction between evaluations, cognitive, affective, and behavioral responses as separable yet related aspects of attitudes (e.g., Eagly & Chaiken, 1993, 1998; Haddock & Zanna, 1999; Zanna & Rempel, 1988, but see Bagozzi, 1978).

As noted previously, both emotion and attitude literature use terms similar to affective and semantic valence. From a bird's eye view, at an abstract level, this distinction indeed partially overlaps with our distinction of affective and semantic. However, the prevalent distinction in these two literatures is somewhat crude and is often too vague in terms of what defines as an "affective" or "semantic" aspects of valence, which in turn projects on empirical inquiry and the interpretation of findings. First, the underlying modes of valence (affective or semantic) is not directly addressed and therefore the interpretation of self-reports in unclear. For instance, to access affective aspect of valence, both in emotion and attitude research, participants might be asked to evaluate how pleasant or unpleasant a stimulus is, but without clear instructions, the self-reported values can reflect not only affective properties but also other aspects, such as semantic and episodic knowledge. Second, in some cases what defines affective or semantic is the content or title of the stimuli and not the underlying representation of valence. As a consequence, what might appear as affective by title is actually semantic representation in disguise. For example, to access the "affective" and "cognitive/semantic" determinants of attitudes, Trafimow and Sheeran (1998) asked participants to respond on a bipolar scale to the statement "my smoking cigarettes is/would be . . ." using words that reflect what they termed "cognition" (e.g., "harmful/beneficial") and words that presumably reflect "affect" (e.g., "pleasant/unpleasant"). However, note that the participants were not asked to report about their current emotional response to smoking (i.e., affective valence in our terms), but rather recollection of what they usually feel about smoking. Clearly, the content of the words does not attest to the underlying representation of valence.

This lack of clarity between what constitutes affective and semantic/cognitive leads to several inconsistencies in the literature. One such inconsistency concerns the very nature of the distinction between affective and cognitive/semantic in attitude literature. Some studies find support for both affective and cognitive determinants of attitude (e.g., Breckler, 1984; Breckler & Wiggins, 1989; Crites, Fabrigar, & Petty, 1994; Eagly, Mladinic, & Otto, 1994; Haddock, Zanna, & Esses, 1993; Ostrom, 1969), other analyses failed to support the distinction (e.g., Bagozzi, 1978; Breckler & Wiggins, 1989).

Inconsistent findings also emerge between different measures of attitudes. Attitudes are measured with self-reports (usually referred to as "explicit measures") and reaction time (RT) tasks (usually referred to as "implicit measure"; Gawronski & Bodenhausen, 2007, but see Fazio & Olson, 2003) and less frequently with physiological measures (e.g., Cacioppo & Petty, 1979; Cunningham & Zelazo, 2007). Although self-reports measures are usually highly correlated with each other, there is a low to no correlation between self-reports to implicit measure and between different types of implicit measures (Gawronski & Bodenhausen, 2007; Gawronski, Hofmann, & Wilbur, 2006). The lake of consistent strong correlations between the measures raises a question whether, or in what sense, the various uncorrelated measures reflect different trajectories of the same underlying construct (Fazio & Olson, 2003; Gawronski & Bodenhausen, 2007; Gawronski et al., 2006; Schwarz, 2007; Schwarz & Bohner, 2001; Wilson, Lindsey, & Schooler, 2000). We suggest that what seems an inconsistent relation between affective and cognitive/semantic or explicit and implicit measures is actually a failure to take into account the distinction between semantic and affective representations of valence. In this work, we attempt to elucidate this distinction and offer an empirical paradigm to tease them apart. We believe that this distinction has the potential to clarify inconsistencies in emotion and attitude domains, both at the theoretical and empirical levels.

The Present Study

The subjective and often covert nature of our emotional states makes the affective and semantic modes of valence difficult to separate from one another for purposes of objective inquiry. One reason that the dissociation is particularly challenging to investigate is that there is a high degree of correlation between the two in any given setting, meaning that the emotional response is often determined, or inextricably colored, by the activation of semantic knowledge (Folkman, Lazarus, Dunkel-Schetter, DeLongis, & Gruen, 1986), or vice versa (Zajonc, 1980). Moreover, some theories would describe the two modes of valence as completely fused so that the dissociation suggested here is, by definition, impossible (e.g., Scherer, 1984).

Although affective and semantic valence are frequently fused in emotional states, in the current study, habituation protocol provides the window that allows looking into the possible dissociation between affective and semantic modes of valence. Habituation is defined as a response attenuation that stems from repeated exposure to a stimulus, which cannot be explained in terms of adaptation, sensory, or motor fatigue (Groves & Thompson, 1970; Rankin et al., 2009; Thompson & Spencer, 1966). Habituation protocol has been employed not only to investigate habituation per se, but also as a means of dissociating two processes that are highly correlated or that appear to be fused upon initial exposure to stimuli (e.g., Bradley, Lang, & Cuthbert, 1993; Codispoti, Ferrari, De Cesarei, & Cardinale, 2006; Hearst, 1988; Hinde, 1970).

We hypothesize that repeated exposure will selectively influence affective and semantic valence. At the base of our attempt for using habituation protocol to dissociate between affective and semantic valence lies the notion that the emotional response represents a set of time-sensitive changes, the intensity of which can increase and decrease in close temporal proximity. For instance, witnessing a car accident can elicit a rapid onset of unpleasant feelings, which will gradually decrease over time. Thus, habituation is expected to be observed for processes that are sensitive to momentary changes. Namely, we predict repeated exposure to influence affective but not semantic valence. Indeed, habituation has been documented in time-sensitive physiological measures of the emotional response, such as facial electromyography (Bradley et al., 1993), early heart rate response (Bradley et al., 1993; Codispoti, Ferrari, & Bradley, 2006), and components that are related to undifferentiated arousal and orienting responses, such as electrodermal activity (Bradley et al., 1993; Codispoti, Ferrari, De Cesarei, & Cardinale, 2006), late component of event-related potential (ERP; Codispoti, Ferrari, & Bradley, 2006).

On the other hand, it is unlikely that semantic knowledge can exhibit habituation. First, semantic knowledge is not a response to stimuli, but rather a representation of meaning retrieved from long-term memory. That meaning can be habituated because repeated exposure is inconsistent with the fact that everyday object and events do not lose their meaning as a function of the frequency with which we are exposed to them. Empirical evidence suggests that conceptual changes (i.e., learning that changes an existing concept) can be especially challenging (see Chi & Roscoe, 2002). Second, attenuation of semantic knowledge through repeated exposure seems inefficient in survival terms. Taking the previous example of washing an apple, imagine what would happen if knowledge about possible contamination would be attenuated after washing the first five apples (see also Dijksterhuis & Smith, 2002, for a similar view). Third, because habituation is time- and context-specific, habituated response is subject to renewal (Storsve, McNally, & Richardson, 2010), whereas semantic knowledge represents a relatively stable construct. Fourth, this view is also consistent with previous interpretations of absence of habituation. For example, Codispoti, Mazzetti, and Bradley (2009) found that some arousal-related signals were unaffected or only slightly affected by repeated exposure and interpreted this lack of habituation as being linked to semantic categorization. Specifically, the early arousal-modulated ERP component that survives repeated exposure has been interpreted to be an "obligatory attentional process that relates to semantic categorization."

In traditional emotion research, measures are likely to reflect both affective and semantic aspects of valence. We chose the measures that reflect ongoing changes in responses to the stimulus as representing affective valence, and time-insensitive knowledge-based responses to the stimulus, as measures of semantic valence. Specifically, we chose physiological measures of facial muscle activation (e.g., Bradley, Codispoti, Cuthbert, & Lang, 2001; Kron et al., 2013; Lang et al., 1993) heart rate (e.g., Bradley et al., 2001; Lang et al., 1993) as measures of affective valence. Another measure of affective valence is "feelings-focused" self-reports. Traditional self-reports of positive and negative feelings (e.g., valence scale; Lang, Bradley, & Cuthbert, 1997) reflect not only one's feelings, but also nonexperiential information such as beliefs about expected emotions that rely on semantic knowledge (Levenson, 2003; Robinson & Clore, 2002a). Feelings-focused instructions encouraged participants to report their actual feelings and not semantic knowledge about the content of the stimuli (Kron et al., 2014).

The first measure of semantic valence is the "knowledge-focused" self-report and the. In contrast to the feelings-focused instructions we developed instructions to systematically encourage participants to report on the content of the stimuli and not their feelings (e.g., for a picture of a car accident, participants are asked to report the degree to which a car accident is a negative event and not about the unpleasantness that they felt while viewing the pictures—see Method section). The second measure of semantic valence is the congruency effect of affective Simon task. In a typical affective Simon task (De Houwer, Crombez, Baeyens, & Hermans, 2001; De Houwer & Eelen, 1998), participants are presented with stimuli belonging to one of two categories (e.g., animal vs. human) and are instructed to say the word "positive" if the stimulus is a human and "negative" if an animal (or vice versa). Independent of the required response, stimuli can be positive (cute animal, smiling baby) or negative (abused animal, crying baby). Thus, the required response (saying positive/negative for animal or human) and the irrelevant feature (positive/negative stimulus meaning) can be congruent or incongruent, and the congruency effect (measured by the difference in RT between incongruent and congruent conditions), is interpreted as evidence for processing the task irrelevant features of the stimuli. It is important that although the stimuli can elicit an emotional response, semantic analysis of the stimuli as positive or negative suffices to elicit the congruency effect.

Indeed, recent evidence suggests that the affective Simon task reflects one example of vast congruency effects that result from conflicts between response and stimulus meaning (Duscherer, Holender, & Molenaar, 2008). For example, as in the affective Simon task, the results of the semantic Simon task (De Houwer, 1998) showed interference between the nonaffective meaning of the irrelevant feature and the response.[1] Furthermore, findings show no modulation of the affective Simon congruency effect by the degree of valence. Specifically, even though emotional pictures typically elicit stronger emotional responses than emotional words (Larsen, Norris, & Cacioppo, 2003), both appear to produce a similar magnitude of congruency effects in the affective Simon task (see Experiment 1 vs. Experiment 3, De Houwer et al., 2001). Therefore, in the current study, we assumed that the affective Simone congruency effect does not rely on an emotional response but rather reflects semantic valence. As a consequence, we hypothesized that the "affective" congruency effect should not be sensitive to repeated exposure manipulation and should not exhibit dilution in response to habituated pictures.

The present study comprised of two experiments. In Experiment 1, participants performed two tasks: a habituation task that combined both behavioral (feeling and knowledge-focused self-reports) and psychophysiological measures (facial electromyography [EMG], heart rate), and an affective Simon task. Experiment 2 was conducted to rule out alternative interpretation of the results of the affective Simon task. We hypothesize that repeated exposure to the same set of stimuli is expected to result in a strong habituation curve for measures that relate to the valence of the emotional response (feeling-focused self-reports, facial EMG, and heart rate), whereas semantic knowledge-based measures (knowledge-focused self-reports and the congruency effect of the affective Simon task) are expected to exhibit little or no habituation.

[1] In the semantic version of the Simon task, participants were asked to respond (say "animal" or "occupation") to a relevant feature of stimulus (if words appeared in English or Dutch) and ignore irrelevant features (if the meaning of the word is an animal or occupation).

Experiment 1

At the first stage of this experiment, two groups of participants, one that received feelings-focused instructions and the other knowledge-focused instructions, viewed an identical set of pictures that belong to the pleasant, unpleasant, or neutral category. The experimental task consisted of three blocks: In the first rating block, participants provided self-report ratings about each picture. In the second block, previously rated pictures were repeatedly viewed by the participants (without rating). In the last block, participants rated the pictures from the first two blocks and a set of novel pictures. Pattern of habituation is examined by the difference in all indices (a) between the first and the sixteenth (last) presentation of the same picture, and (b) between the sixteenth presentation of the same picture and a novel set of pictures not previously seen by the participants. Facial EMG and heart rate were collected throughout the first stage of the experiment. At the second stage of this study, following the completion of the first task, participants performed an affective Simon task with two sets of pictures: previously habituated and a set of new pictures.

Method

Participants. Fifty undergraduate students (39 women) from University of Haifa participated in this study, ranging in age from 19 to 40 ($M = 24.15$, $SD = 4.17$). The participants received either course credit or monetary compensation for their participation. All participants had normal or corrected-to-normal vision. The participants were randomly assigned into one of the two instructions groups: (a) feeling-focused, instructions that tap affective feelings (b) knowledge-focused, instructions that tap semantic knowledge.

Stimuli. A total 108 pictures collected from the Internet were chosen for this experiment—12 for each valence condition (pleasant, unpleasant, and neutral)—divided into three lists of 36 pictures each. The pictures conveyed either animals or humans with special attention dedicated to making sure that no picture represents human facial expressions that could potentially lead to mimicry. Pictures with pleasant valence contained pictures of cute animals, children and fun activities (e.g., dancing). Pictures with unpleasant valence contained pictures of abused animals, injuries and negative events such as funerals. Pictures with neutral valence contained people walking down the street and participating in everyday activities (e.g., cleaning the house) and animal pictures. Distributions of ratings for the three valence conditions show minimal to no overlap (see SOM1 available online as supplemental materials). All pictures were sized 700×530 pixels (depending on orientation) and were presented on a black background.

Self-report instructions about feelings and semantic knowledge

Feelings-focused. Based on Kron, Pilkiw, Banaei, Goldstein, and Anderson (2015), self-report instructions were developed to reflect participant's internal feelings, as oppose to evaluations based on semantic knowledge, expectations or beliefs. To achieve that, we used three rating scales ranging from 0 (*none*) to 8 (*high*): emotional feelings scale (rating the maximum value of any type of emotional feelings such as arousal, pleasure, displeasure, or any other feeling), pleasure scale (rating feelings of pleasure, happiness, and/or any other pleasant feelings), and displeasure scale (rating feelings of displeasure, sadness). See SOM2 (available online as supplemental material) for translated instructions procedure and the rating scales.

In the beginning of the instructions procedure, participants were explained about the distinction between "feeling" and "knowing." In particular we emphasized two cases: (a) confusing evaluation of feelings with evaluation of the content of the picture (e.g., you feel an unpleasant\negative feeling vs. the content of the picture is unpleasant\negative), and (b) confusing feelings with belief or expectation about what "one should feel" while looking at a picture.

Next, participants were familiarized with the three scales. We used the first scale (emotional feelings) to frame the task as an "emotion detection task". Participants were explained that they can think of this scale as a volume knob that indicates the intensity of their emotions and that the question is whether they detected ANY emotion (e.g., pleasant and unpleasant, arousing etc.). If no feelings were detected, they were asked to press [0], if the participants did detect an emotional feeling, they were asked to rate the intensity of that feeling. The purpose of this scale was to reduce the accessibility bias (e.g., reports about semantic knowledge in the absence of strong feelings) by legitimizing cases of no emotional feelings. If a participant detects feelings, the next two scales asked how positive\negative those feelings were.[2]

Knowledge-focused. These instructions were developed to reflect participants' evaluation of the event. To achieve that, we used the same pleasure and displeasure scales as in the self-report about feelings, but this time, the participants were instructed to rate how positive/negative the picture was. Participants were explained that they are asked about the valence of the picture, not about their internal feelings. See SOM2 for translated instructions and the rating scales.

Physiological data acquisition. Physiological data was recorded and amplified with a multichannel BioNex 8-slot chassis (Mindware Technologies, Grahanna, OH) equipped with a two BioNex 4-channel bio potential amplifier (Model 50–371102-00). All data was sampled at 1,000 Hz and transmitted to a computer for viewing and storage using MindWare acquisition software BioLab 2.4. The experiment was designed using E-Prime 2 professional software (Schneider, Eschman, & Zuccolotto, 2002), run on a HP PC and a 23" color monitor.

Facial electromyography (EMG). Surface EMG was recorded from the zygomaticus major and corrugator supercilii muscles on the left side of the face (Cacioppo, Petty, Losch, & Kim, 1986) with 4-mm miniature Beckman Ag/AgCl electrode pairs filled with designated gel. Before electrode application, designated skin sites were abraded with Nuprep (Weaver and Company, Aurora, CO).

Heart rate. Heart rate was extracted from electrocardiogram (ECG) signal that was recorded using Mindware Technology's software with two electrodes placed at the right collar bone and the 10th-left rib.

Design and procedure. Participants were tested individually in a quiet room. Upon arrival, they were asked to sign a consent

[2] To equate as much as possible between feelings-focused and knowledge-focused valence scales, we used "positive" and "negative" to refer to both feelings and knowledge. However, in this article, we use "pleasant" and "unpleasant" when referring to feelings, while "positive" and "negative" are used to describe knowledge.

form; then they were connected to EMG and electrocardiogram (ECG) electrodes and were randomly assigned to one of two instructions groups (feelings-focused or knowledge-focused). They were seated approximately 60 cm from the computer monitor and were asked to sit without making extensive movements or touching the face. The participants first completed the habituation protocol and then an experimenter unhooked the electrodes and administered the Affective Simon task. Hidden video camera recorded participant's faces during the EMG recording to remove movement artifacts. The participants were informed about the recording at the end of the experiment and were asked to provide their consent for using it. Upon refusal, the video recording was deleted.

Habituation protocol. Each of the two instructions groups went through identical habituation protocol. The habituation protocol comprised of three blocks: a rating block, a habituation block and a testing block. In the rating block, 36 pictures (12 of each valence condition) were presented for 4 s each. Each picture was followed by 3 (feelings-focused) or 2 (knowledge-focused) rating scales (see feelings-focused and knowledge-focused instructions for detailed discussion about the scales). Participants were asked to provide self-report ratings about each picture. After the rating scales, a black screen remained for an average of 8.5 s. In the habituation block, the same pictures that were presented in the rating block were randomly presented 14 times for 3 s each. Participants were instructed to watch the pictures without rating them. In the last testing-block, two sets of pictures were presented: one set consists the pictures from the habituation block and the second include 36 new pictures, not previously seen by the participants. Each picture of the two sets was presented for 4 s and followed by rating scales. The habituation protocol started with three practice trials in which participants were asked to rate the pictures (according to their instructions group).

Affective Simon. In this task, 36 pictures that underwent habituation were randomly presented with a set of 36 new pictures not previously seen by the participants. Each picture conveyed either animal or human and was positive, negative or neutral. Participants were instructed to say "positive" if a picture conveyed an animal and "negative" if picture conveyed a human, or vice versa (counter balanced between participants). Thus, the affective Simon task had valence of stimuli (pleasant, unpleasant and neutral), category of stimuli (animal, human), congruency (congruent, incongruent, filler; emerge from the mapping between the valence of stimuli and the response), and habituation (old, novel) as within-participant variables. Each trial started with a 500-ms fixation cross followed by a 500-ms blank screen, and then a picture was presented, which remained on the screen until the participant responded for a maximum of 3 s. ISI was 1,000 ms. The experimenter manually marked incorrect responses and malfunctioning of the microphone.

Preprocessing and data reduction.

Self-report. We estimated self-report using two different measures; bipolar valence score and frequency of pictures rated as neutral. In the first, the two unipolar self-reports scores of pleasure and displeasure were converted into a single bipolar valence score (positive minus negative) for the purpose of fluency of reading the data analysis (Kron et al., 2015; Larsen et al., 2003).[3] In the second measure, relative frequency of pictures rated as neutral (value of zero on both positive and negative scales) was computed specifically to reflect effectiveness of repeated exposure manipulation.

EMG. Prior to the preprocessing, artifact removal was done by inspecting the video recording. The following artifacts were removed (with experimenter blind to experimental conditions): yawning, lip licking and biting, scratching, and similar unrelated movements. Overall, EMG data from five (one from the feelings-focused group) participants was not analyzed because of the following reasons: failure of the EMG recording ($n = 1$), participant request to delete the video ($n = 1$) and high percentage of unrelated movements ($n = 3$). The final sample for the EMG analysis contained 45 participants (37 women), ranging in age from 18 to 35 ($M = 24.6$, $SD = 4.6$). EMG change score was computed as the mean activation of zygomaticus and corrugator during 4 s of picture presentation in the first and third blocks and divided by mean activation in the 1 s (baseline) prior picture presentation (Lang et al., 1993). Preprocessing was done with MATLAB R2014a (MathWorks Inc.). EMG signals were rectified by absolute value and fed into a 20–450 Hz Butterworth band-pass filtered (Butter, filtfilt, MATLAB).

Heart rate. Heart rate was filtered using a high-pass filter of 5 Hz. The analysis of ECG signal was performed offline using Mindware Technology's HRV 3.0.25 software. Artifacts were manually removed from the analysis. Data from 4 participants was not analyzed because of malfunctioning of the recording. Heart rate score was computed as the mean heart rate (analyzed using Mindware Technologies analysis program for HRV v. 3.0.25) following the first 3 s after stimulus onset subtracted from mean heart rate in 2 s prior stimulus presentation (baseline; e.g., Aue, Hoeppli, Piguet, Sterpenich, & Vuilleumier, 2013; Palomba, Angrilli, & Mini, 1997).

Results

Manipulation check for all measures.

Self-report. Manipulation check analysis was performed on the first presentation block using mean bipolar valence score computed for each condition for each participant. Two analyses of variance (ANOVAs), one for each instructions group, were conducted with valence condition (i.e., pleasant, unpleasant and neutral) as a within-participant variable. For the feelings-focused group, the main effect of valence was significant, $F(2, 48) = 123.31$, $p < .0001$, $\eta_p^2 = .837$. Pictures that were selected for the pleasant condition were rated as more pleasant ($M = 3.51$, $SD = 1.95$) than unpleasant ($M = -3.68$, $SD = 1.65$), $t(24) = 10.62$, $p < .0001$, Cohen's $d = 3.933$, and neutral pictures ($M = .74$, $SD = .85$), $t(24) = 8.09$, $p < .0001$, Cohen's $d = 1.818$. Pictures that were selected for the unpleasant condition were also rated as more unpleasant than neutral, $t(24) = 11.06$, $p < .0001$, Cohen's $d = 3.329$. For the knowledge-focused group, the main effect of valence was significant, $F(2, 48) = 235.20$, $p < .0001$, $\eta_p^2 = .907$. Pleasant pictures ($M = 5.71$, $SD = 1.41$) were rated as more

[3] The correlations between positive and negative scales were negative in both instruction conditions ($r = -.68$, $p < .001$, $r = -.80$, $p < .001$, in feelings- and knowledge-focused, respectively). Therefore, to simplify the results section, the positive and negative scales were converted into valence scale (Positive minus Negative). No difference in the pattern of results obtained by using the two unipolar scales separately.

pleasant than unpleasant ($M = -4.75$, $SD = 1.40$), $t(24) = 21.44$, $p < .0001$, Cohen's $d = 7.460$, and neutral pictures ($M = 1.93$, $SD = 1.55$), $t(24) = 14.65$, $p < .0001$, Cohen's $d = 4.533$. Pleasant pictures were also rated as more unpleasant than neutral, $t(24) = 12.20$, $p < .0001$, Cohen's $d = 2.569$.

Facial EMG. Manipulation check analysis for facial EMG was performed on the first presentation block using EMG scores collapsed across the two instruction groups (interaction between instruction groups and valence was neither predicted nor obtained, $F < 1$, $F(2, 86) = 1.58$, $p < .21$, $\eta^2_p = .036$, for corrugator and zygomatic respectively).

Corrugator supercilii. A repeated measures ANOVA compared the activation pattern of corrugator supercilii in unpleasant, pleasant and neutral conditions, $F(2, 88) = 46.64$, $p < .0001$, $\eta^2_p = .515$. Replicating previous results, activation of corrugator during the unpleasant condition ($M = 1.19$, $SD = .26$) was significantly stronger than during pleasant ($M = .86$, $SD = .19$), $t(44) = 8.91$, $p < .0001$, Cohen's $d = 1.149$, and neutral ($M = 1.11$, $SD = .19$) conditions, $t(44) = 2.22$, $p < .05$, Cohen's $d = .351$.

Zygomaticus major. A repeated measures ANOVA was conducted to compare the activation pattern of zygomaticus in pleasant, unpleasant and neutral conditions, $F(2, 88) = 22.21$, $p < .0001$, $\eta^2_p = .335$. Activation of zygomatic during the pleasant condition ($M = 2.13$, $SD = 1.61$) was significantly stronger than during unpleasant ($M = 1.03$, $SD = .14$), $t(44) = 4.65$, $p < .0001$, Cohen's $d = .963$, and neutral ($M = 1.03$, $SD = .28$) conditions, $t(44) = 4.84$, $p < .0001$, Cohen's $d = .952$.

Heart rate. Again, manipulation check for heart rate was done on the first presentation block, using heart rate scores collapsed across the two instruction groups (interaction between instructions groups and valence $F(2, 88) = 1.27$, $p < .29$, $\eta^2_p = .028$). We expected that during first presentation, heart rate deceleration will be strongest during unpleasant pictures, followed by pleasant pictures and neutral pictures (but see Bradley et al., 2001). Planned t tests revealed that during first presentation, heart rate decelerated more during unpleasant ($M = -1.19$, $SD = 1.41$) than neutral ($M = -.31$, $SD = 1.65$), $t(45) = 2.70$, $p = .01$, Cohen's $d = .524$, and pleasant pictures ($M = .01$, $SD = 1.61$), $t(45) = 3.56$, $p = .001$, Cohen's $d = .724$. No difference was found between neutral and pleasant conditions, $t(45) = 1.07$, $p < .29$, Cohen's $d = .181$ (for similar pattern see Bradley et al., 2001).

Habituation of self-reports and psychophysiology. Pattern of habituation was examined by the difference in all indices between (a) the first and sixteenth (last) presentation of the same picture, and (b) the sixteenth (last) presentation and novel pictures. The latter was conducted to rule out general fatigue accounts of habituation. We hypothesized that measures of affective valence will demonstrate habituation with repeated exposure whereas measures of semantic valence will show no change. Therefore, we supplemented the analysis of all the simple effects of semantic valence indices with Bayesian analysis (see SOM3 and SOM4).

Self-reports. We hypothesized that feelings-focused (but not knowledge-focused) self-reports will exhibit habituation. Namely, we predicted an interaction between instructions group and exposure. To this end, we conducted 2 (exposure: first, last/last, novel; within participant factor) $\times$ 2 (instructions group: feelings-focused, knowledge-focused; between participant factor) mixed design ANOVAs for pleasant and unpleasant pictures. First, we compared self-reports in the first and last presentations for pleasant pictures. The analysis showed a significant interaction between exposure and instruction group, $F(1, 48) = 14.63$, $p < .0001$, $\eta^2_p = .234$. As can be seen in Figure 1, self-report about feelings exhibited a significant attenuation between first and last (i.e., sixteenth) presentations, $t(24) = 4.74$, $p < .0001$, Cohen's $d = .663$, while self-reports about knowledge did not, $t(24) = 1.59$, $p < .13$, Cohen's $d = .128$. Similar analysis for unpleasant pictures also yielded a significant interaction between exposure and instructions group, $F(1, 48) = 22.02$, $p < .0001$, $\eta p^2 = .314$. Self-reports about feelings attenuated significantly from first to last presentation, $t(24) = 4.39$, $p < .0001$, Cohen's $d = .441$, while self-reports about knowledge did not decrease, if anything, they showed the opposite pattern, $t(24) = 2.20$, $p < .05$, Cohen's $d = .233$ (Figure 1).

To rule out the possibility that habituation is explained by general fatigue, we compared the self-reported valence scores of the sixteenth presentation and the first presentation of novel pictures appeared in the same block. The analysis for pleasant pictures showed a significant interaction between exposure and instruction group, $F(1, 48) = 9.86$, $p < .01$, $\eta^2_p = .170$. As can be seen in Figure 1, self-report about feelings exhibited a significant increase between the last presentation of the repeated pictures and the first presentation of the novel pictures, $t(24) = 3.68$, $p < .001$, Cohen's $d = .491$, while there was no significant change in self-reports of knowledge, $t < 1$. A similar analysis for the unpleasant pictures also showed a significant interaction between exposure and instructions group, $F(1, 48) = 4.48$, $p < .05$, $\eta^2_p = .08$. Self-reports about unpleasant feelings increased from the repeated to novel pictures, $t(24) = 4.38$, $p = .0001$, Cohen's $d = .588$, while self-report of knowledge showed no change, $t < 1$.

We then estimated the exposure effect and its interaction with instructions group using the measure of frequency of neutral responses for pleasant and unpleasant valence conditions. Neutral responses were defined as cases when all scales were rated with 0. This measure indicates not only attenuation but the total elimination of affective valence because of repeated exposure. First, we compared the frequency of pictures rated as neutral in the first and last presentations for pleasant pictures. The analysis showed significant interaction between exposure and instructions group, $F(1, 48) = 4.67$, $p < .05$, $\eta^2_p = .089$. The frequency of pictures rated as neutral increased with exposure, $t(24) = 2.80$, $p < .01$, Cohen's $d = .551$, $t(24 = 2.07$, $p < .05$, Cohen's $d = .517$, for feelings-focused and knowledge-focused respectively), but as can be seen in Figure 2, and indicated by the above significant interaction, the increase in frequency was significantly higher under feelings-focused instructions (from $M = 10\%$, $SD = 16\%$, to $M = 22\%$, $SD = 26\%$ under feelings-focused instructions, and from $M = 3\%$, $SD = 6\%$, to $M = 2.7\%$, $SD = 6.3\%$ under knowledge-focused instructions). Similar analysis for unpleasant pictures yielded a marginally significant interaction between exposure and instructions group, $F(1, 48) = 2.96$, $p < .10$, $\eta^2_p = .058$. Planned comparisons revealed that as expected, the increase in the frequency of pictures rated as neutral was significant under feelings-focused instructions, $t(24) = 2.76$, $p < .05$, Cohen's $d = .442$ but not significant under knowledge-focused instructions, $t(24) = 1.40$, $p < .17$, Cohen's $d = .207$.

Next, we compared the frequency of pictures rated as neutral during the last presentation of previously seen pleasant pictures and first presentation of novel pleasant pictures. The analysis showed a significant interaction between exposure and instructions

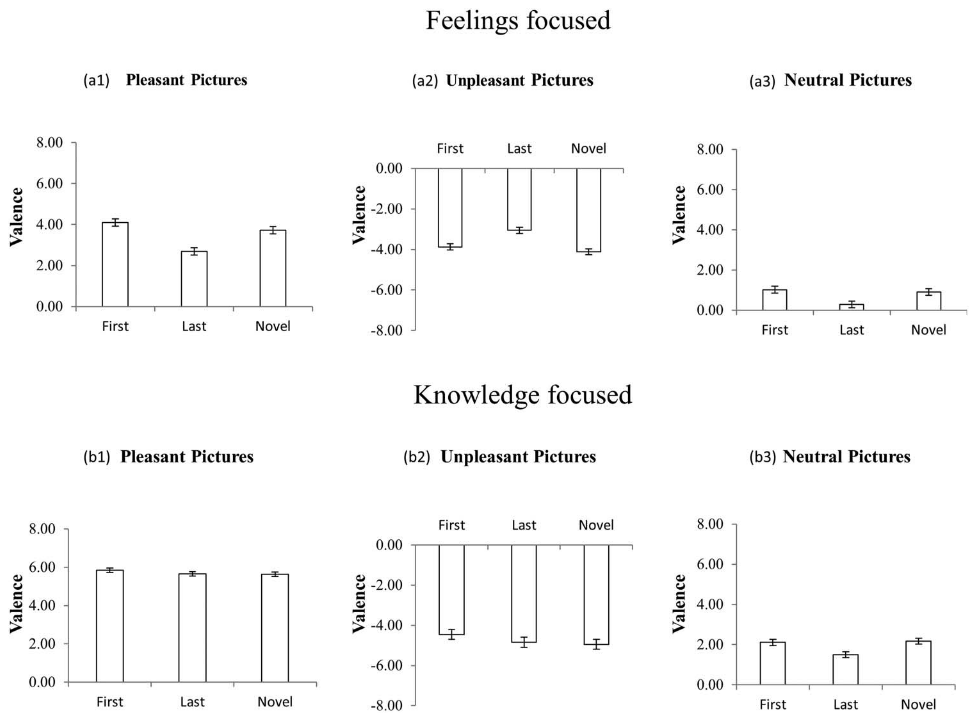

Figure 1. Self-reports of the feelings-focused (a1–3) and knowledge-focused group (b1–3). Habituation is computed as the difference between the intensity of valence ratings during first presentation compared with last presentation and as a difference between the last presentation and novel pictures. Error bars depict 1 *SEM*.

group, $F(1, 48) = 5.83$, $p < .05$, $\eta_p^2 = .108$. As expected, the difference in the frequency of pictures rated as neutral decreased between the last presentation of the repeated pictures and the first presentation of the novel pictures was significant under feelings-focused instructions, $t(24) = 2.69$, $p < .05$, Cohen's $d = .499$, but not under knowledge-focused instructions ($t < 1$). A similar analysis for the unpleasant pictures also showed a significant interaction between exposure and instructions group, $F(1, 48) = 6.89$, $p < .05$, $\eta_p^2 = .126$. The frequency of pictures rated as neutral showed a greater increase from the repeated to novel pictures under feelings-focused than knowledge-focused instructions, $t(24) = 6.15$, $p < .0001$, Cohen's $d = 1.078$, $t(24 = 3.11$, $p < .01$, Cohen's $d = .747$, respectively).

Facial EMG.

Corrugator supercilii. First, we compared the pattern of corrugator activation between the first and last (sixteenth) exposure of the same picture. The common finding is that corrugator shows above baseline activation during displeasure and inhibitory effect (activation bellow baseline) during pleasure (e.g., Lang et al., 1993). Thus, to the extent that corrugator habituates with repeated exposure we expect interaction between valence conditions (pleasant vs. unpleasant) and exposure condition (first vs. last). A repeated measures ANOVA showed significant interaction, $F(1, 44) = 21.75$, $p < .0001$, $\eta_p^2 = .331$, resulting from an attenuation in the corrugator inhibitory effect (from first to last block) in the pleasant condition, $t(44) = 4.94$, $p < .0001$, Cohen's $d = .916$, on the one hand, and nonsignificant reduction in corrugator activation in the unpleasant condition, $t(44) = 1.55$, Cohen's $d = .280$ on the other hand (Figure 3). To confirm that habituation is not accounted for by general fatigue, we next compared the activation pattern between the last exposures of previously repeated pictures and first exposure of novel pictures. We predict that habituation will be recovered by novel pictures, such that, activation of corrugator in the unpleasant condition, and inhibitory effect in the pleasant condition, will both increase comparing to the last presentation of repeated pictures. A repeated measures ANOVA confirmed this prediction. The interaction between exposure (last vs. novel) and valence (pleasant vs. unpleasant) was significant, $F(1, 44) = 27.80$, $p < .0001$, $\eta_p^2 = .387$. The interaction resulted from an increase (from repeated to new pictures) in the corrugator activation in the unpleasant condition, $t(44) = 3.82$, $p < .0001$, Cohen's $d = .697$ and nonsignificant increase in inhibitory effect in the pleasant condition, $t(44) = 1.33$, Cohen's $d = .205$ (Figure 3).

Zygomaticus major. First, we compared the pattern of zygomatic activation between the first and last (sixteenth) exposure of the same picture. Again, we expected an interaction between valence conditions (pleasant vs. unpleasant) and exposure condition (first vs. last). A repeated measures ANOVA showed significant interaction, $F(1, 44) = 18.75$, $p < .0001$, $\eta_p^2 = .299$, resulted from an attenuation in the zygomaticus activation (from first to last block) in the pleasant condition, $t(44) = 4.47$, $p < .0001$, Cohen's $d = .804$, but not the unpleasant condition, $t < 1$ (Figure 3). We predict that habituation will be recovered by novel pictures, and thus, compared the activation during the last presentation of previously repeated pictures and the first presentation of novel pictures. The ANOVA indicated a significant interaction between exposure (last, novel) and valence condition (pleasant, unpleasant), $F(1, 44) = 10.80$, $p < .01$, $\eta_p^2 = .197$; zygomaticus activation

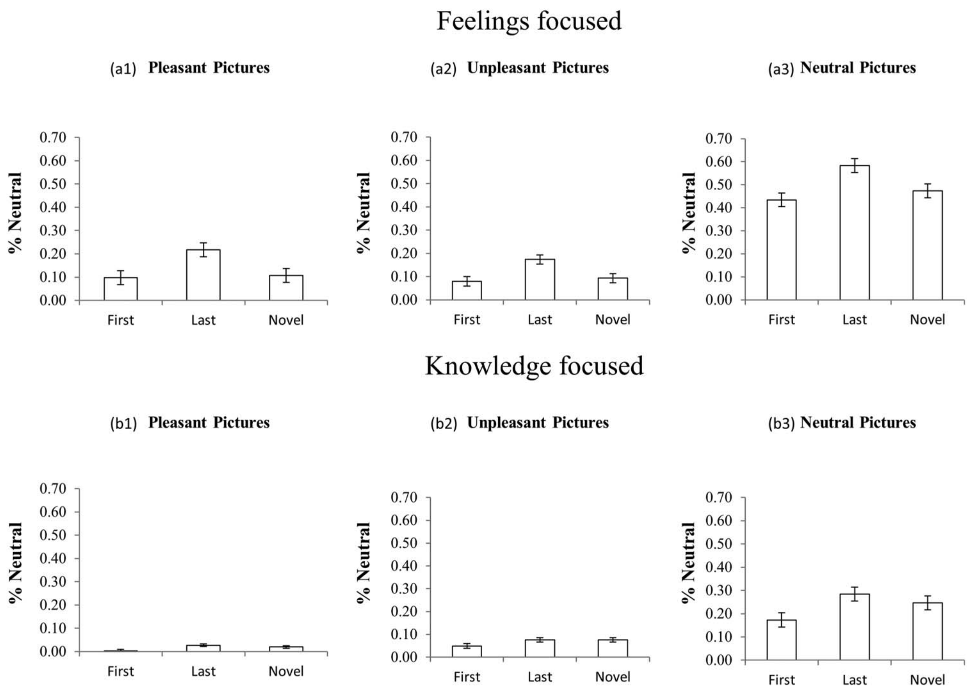

Figure 2. Frequency of pictures that received a “0” value on both valence scales in the feelings-focused group (a1–3) and knowledge-focused group (b1–3). Error bars depict 1 *SEM*.

between last exposure of previously repeated pleasant pictures was significantly smaller compared with activation during exposure to novel pleasant pictures, $t(44) = 3.49$, $p = .001$, Cohen's $d = .602$, while the difference in the unpleasant condition was not significant $t < 1$.

Heart rate. We first compared that the pattern of heart rate between the first and last (sixteenth) exposure of the same picture. A repeated measures ANOVA was conducted on exposure (first, last) and valence condition (pleasant, unpleasant, neutral). The interaction between exposure and valence was significant, suggesting that the exposure had different effect on heart rate between valence conditions, $F(2, 90) = 3.80$, $p < .05$, $\eta_p^2 = .078$. As expected, heart rate deceleration decreased from first to last presentation of the same unpleasant pictures, $t(45) = 4.56$, $p < .0001$, Cohen's $d = .577$. However, the heart rate did not show a decrease of deceleration from first to last presentation of pleasant, $t < 1$, or neutral pictures, $t(45) = 1.84$, $p < .07$, Cohen's $d = .487$ (Figure 4). To the extent that habituation is not explained by general fatigue we next compared the activation pattern between the last exposures of previously repeated pictures and first exposure of novel pictures. We predict that habituation will be recovered by novel pictures. A repeated-measures ANOVA was conducted on exposure (last, novel) and valence (pleasant, unpleasant, and neutral). The interaction between exposure and valence was significant, $F(2, 90) = 5.11$ $p < .01$, $\eta_p^2 = .102$. As predicted, the heart rate deceleration was stronger during presentation of novel unpleasant pictures ($M = -1.67$, $SD = 1.75$) relative to last presentation of previously repeated unpleasant

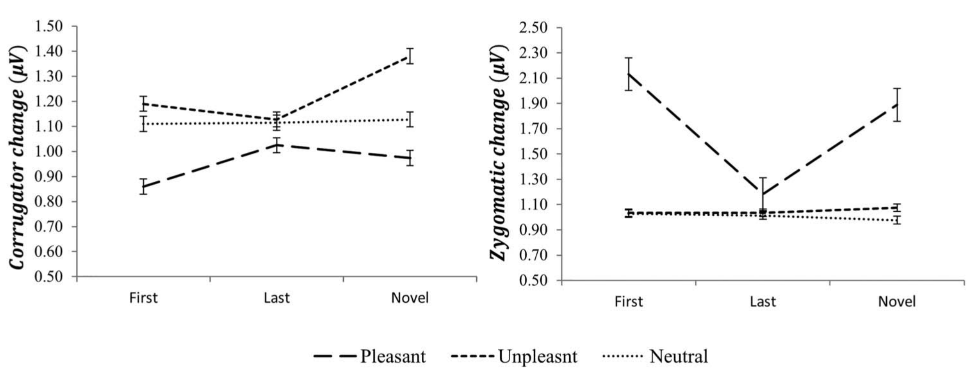

Figure 3. Electromyogram (EMG) change score of corrugator and zygomatic muscles computed as mean amplitude during 4 s of picture presentation divided by mean amplitude of 1 s prior picture presentation. Error bars depict 1 *SEM*.

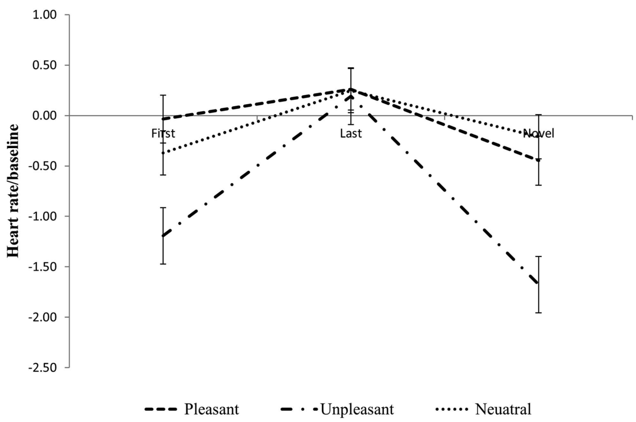

Figure 4. Meat heart rate during first 3 s of picture presentation subtracted from mean heart rate prior picture presentation. Error bars depict 1 *SEM.*

pictures (M = .19, SD = 2.33), $t(45) = 5.37$, $p < .0001$, Cohen's d = .906. In addition, heart rate decelerated between the last exposure of repeatedly presented pleasant pictures (M = .26, SD = 1.57) and new pleasant pictures (M = −.44, SD = 1.80), $t(45) = 2.16$, $p < .05$, Cohen's d = .429. No significant difference between last and new exposure of neutral pictures ($t < 1$).

Affective Simon task. Two participants failed to complete the task (one from each group) and their data was not analyzed. Prior to the analysis, we excluded RTs shorter than 300 ms and longer than 2,000 ms. Only correct trials were analyzed. Overall, 6% of trials were excluded.

Reaction times. Instructions group (feelings-focused, semantic knowledge-focused) and stimulus category (animal, human) did not interact with congruency and/or with habituation (repeated pictures, novel pictures; all $Fs < 1$), and therefore, instruction and category conditions were collapsed. A 2(habituation: old, new) × 3(congruency: congruent, incongruent, filler) repeated measures ANOVA showed a significant main effect of congruency, $F(2, 94) = 37.36$, $p < .0001$, $\eta_p^2 = .443$. Response times were slower for incongruent (M = 761.26, SD = 136.40) than congruent trials (M = 727.83, SD = 126.15), $t(47) = 5.91$, $p < .0001$, Cohen's d = .254. Response times for filler trials (M = 715.40, SD = 126.66) were faster than both congruent and incongruent trials, $t(47) = 2.61$, $p < .05$, Cohen's d = .098, $t(47 = 7.70$, $p < .0001$, Cohen's d = .348, respectively). The interaction between habituation and congruency was not significant, indicating no dilution of the affective Simon congruency effect as a result of habituation (in fact, the trend was in the opposite direction, see Figure 5), $F(2, 94) = 1.97$, $p < .15$, $\eta_p^2 = .040$.

Accuracy. Overall, the accuracy in this experiment was high (98% in the feelings-focused group, and 97% in the knowledge-focused group). Once again, instructions group (feelings-focused, knowledge-focused) and category (animal, human) did not interact with congruency and/or with habituation (repeated pictures, novel pictures) and therefore, these conditions were collapsed. A repeated measures ANOVA revealed a significant main effect of congruency, $F(2, 94) = 4.68$, $p < .05$, $\eta_p^2 = .091$. The accuracy was lower for the incongruent condition (M = 97%, SD = 3%) compared with congruent condition (M = 98%, SD = 3%), $t(47) = 2.56$, $p < .05$, Cohen's d = .411, and compared with the filler condition (M = 98%, SD = 4%), $t(47) = 2.84$, $p < .01$, Cohen's d = −0.379. The interaction between habituation and congruency was not significant, $F(2, 94) = 2.11$, $p < .13$, η_p^2 = .043.

Correlational and statistical control analysis. The logic of the current investigation is that affective and semantic-related measures are highly intercorrelated and that repeated exposure to a stimulus is a mean to tease them apart and unfold the potential dissociation between them. Supporting this hypothesis, feelings-focused and knowledge-focused self-reports are correlated during the first exposure, r = .97, $p < .0001$ (Figure 6a), while the correlation between the slopes, that is, the change scores between first and last exposure to the stimuli (first minus last), r = .19, $p <$ .04 (Figure 6b), is significantly lower z = 13, $p < .0001$.

The next three analyses examine the interrelations between feelings- and knowledge-focused reports and each of the other measures (i.e., corrugator EMG, zygomaticus EMG, and heart rate) averaged across pictures (i.e., item analysis) Each analysis has two parts: The first examines the interrelations during first exposure and the second examines the associations between changes of activations (the correlation between changes from first to last exposure). Activation during first exposure to affective stimuli involves no change because of repeated exposure and consequently, affective and semantic components are expected to demonstrate a strong association. The second part of each analysis examines interrelations between the slopes, that is, the change of response activation to first versus last exposure. Here, in contrast to first exposure, a dissociation between affective and semantic indices is expected.

In addition, each analysis further examines the semantic-affective relations from a statistical control perspective. If semantic and affective components indeed share variance during first exposure, then statistically controlling variance related to semantic component via partial correlation should reduce the association between two affective components, and vice versa, controlling variance between feelings-related components should reduce association between semantic components. However, if there is dissociation between semantic and affective components with re-

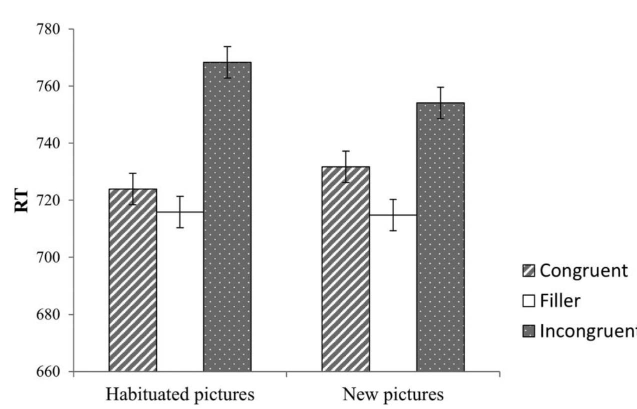

Figure 5. Mean reaction times (RTs) of the affective Simon task during congruent, incongruent, and filler conditions for habituated and novel pictures. Error bars depict 1 *SEM*.

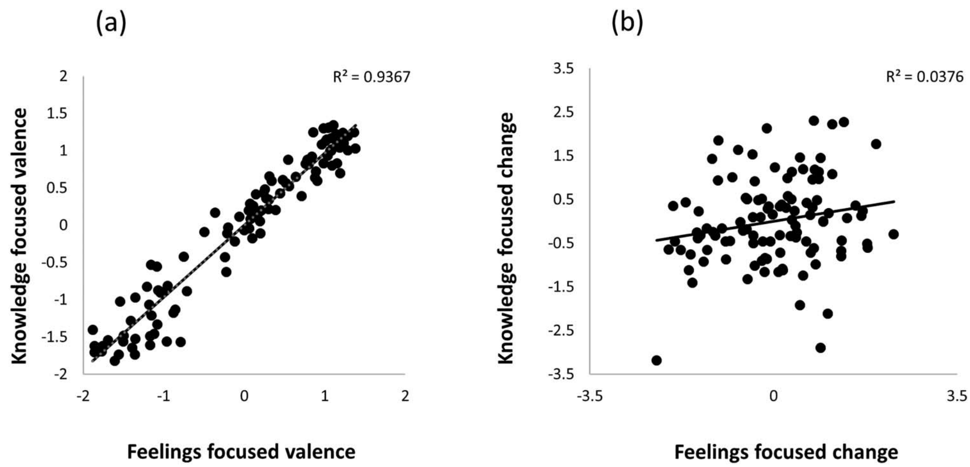

Figure 6. Correlation between (6a) feelings- and knowledge-focused self-reports during the first exposure and (6b) the correlation between the slopes (repeated minus new) of feelings-focused and knowledge-focused self-reports.

peated exposure, partialing-out semantic variance is expected to have minimal or no effect on the association between changes of affective components.[4]

Corrugator EMG.

Association between semantic and affective components in first exposure. As predicted, corrugator EMG is negatively associated with both knowledge-focused, r $= -.72$, $p < .0001$ (Figure 7a), and feelings-focused, r $= -.76$, $p < .0001$ (Figure 2e) reports. Supporting the strong association between affective and semantic components, during first exposure, when feelings-focused scores are statistically partialed out (via partial correlation analysis), the high association between corrugator and knowledge-focused reports is reduced (from $r_{corrugator,\ knowledge} = -.72$) to $r_{corrugator,\ knowledge.feelings} = .14$, nonsignificant (*ns*), and in the same vein, when knowledge-focused reports are partialed out, the correlation between corrugator EMG and feelings-focused reports is reduced (from $r_{corrugator,knowledge} = -.76$) to $r_{corrugator,knowledge} = -.38$, $p < .001$).

Dissociation between semantic and affective components with repeated exposure. Supporting the divergent effect of repeated exposure on affective and semantic components, the slop of corrugator change from first to last exposure was significantly associated with feelings-focused reports, $r = -.36$, $p < .001$ (Figure 7e) but not with knowledge-focused reports, $r = .05$ (Figure 7b). Critically, in contrast to first exposure and supporting the dissociation, controlling variance related to change in knowledge-focused reports did not reduce the association between changes of corrugator and feelings-focused reports, $r = -.38$ (Figure 7h).

Zygomaticus EMG.

Association between semantic and affective components in first exposure. As predicted, Zygomaticus EMG is positively associated with both knowledge-focused, $r = .54$, $p = .0001$ (Figure 8a), and feelings-focused, $r = .59$, $p = .0001$ (Figure 8e) reports. Supporting the strong association between affective and semantic components, during first exposure, when feelings-focused scores are statistically partailed out (via partial correlation analysis), the high association between corrugator and knowledge-focused reports is reduced (from $r_{corrugator,knowledge} = .54$) to $r_{(corrugator,knowledge)feelings} = -.1$, *ns*, and in the same vein, when knowledge-focused reports are partialed out, the correlation between corrugator EMG and feelings-focused reports is reduced (from $r_{corrugator,feelings} = .59$) to $r_{corrugator,feelings(knowledge)} = .27$, $p < .003$.

Dissociation between semantic and affective components with repeated exposure. Supporting the divergent effect of repeated exposure on semantic and affective components, the slop of zygomaticus activation change from novel to repeated stimuli was significantly associated with feelings-focused reports, $r = .37$, $p < .0001$ (Figure 8e), but not with knowledge-focused reports, $r = -.03$, *ns* (Figure 8b). Critically, in contrast to first exposure and supporting the dissociation between affective and semantic components with repeated exposure, controlling variance related to change in knowledge-focused reports did not reduce the association between changes of corrugator and feelings-focused reports, $r = -.38$, $p < .0001$ (Figure 8h).

Heart rate

Association between semantic and affective components in first exposure. As predicted, heart rate is positively associated with both knowledge-focused reports, $r = .45$, $p < .0001$, and feelings-focused reports, $r = .46$, $p < .0001$. Supporting the strong association between affective and semantic components, during first exposure, when feelings-focused scores are statistically partailed out, the high association between corrugator

[4] Affective Simon task is not included in these analyses for two reasons: (a) It is not included in the analysis of activation during first exposure because there is no a priori theoretical reason to predict association between the congruency effects in this task and self-reports. Specifically, heart rate and facial EMG measures are valence related in the sense that they are correlated with self-report valence and show different patterns if the picture is positive or negative. However, the congruency effect of the affective Simon task is not expected to systematically change as a function of picture valence, but rather it depends on the congruency of response to the affective content. (b) It is not included in the analysis that examines interrelations between the slopes, because both congruency effect and the knowledge focused self-reports are not expected to change with repeated exposure and consequently no correlation is predicted.

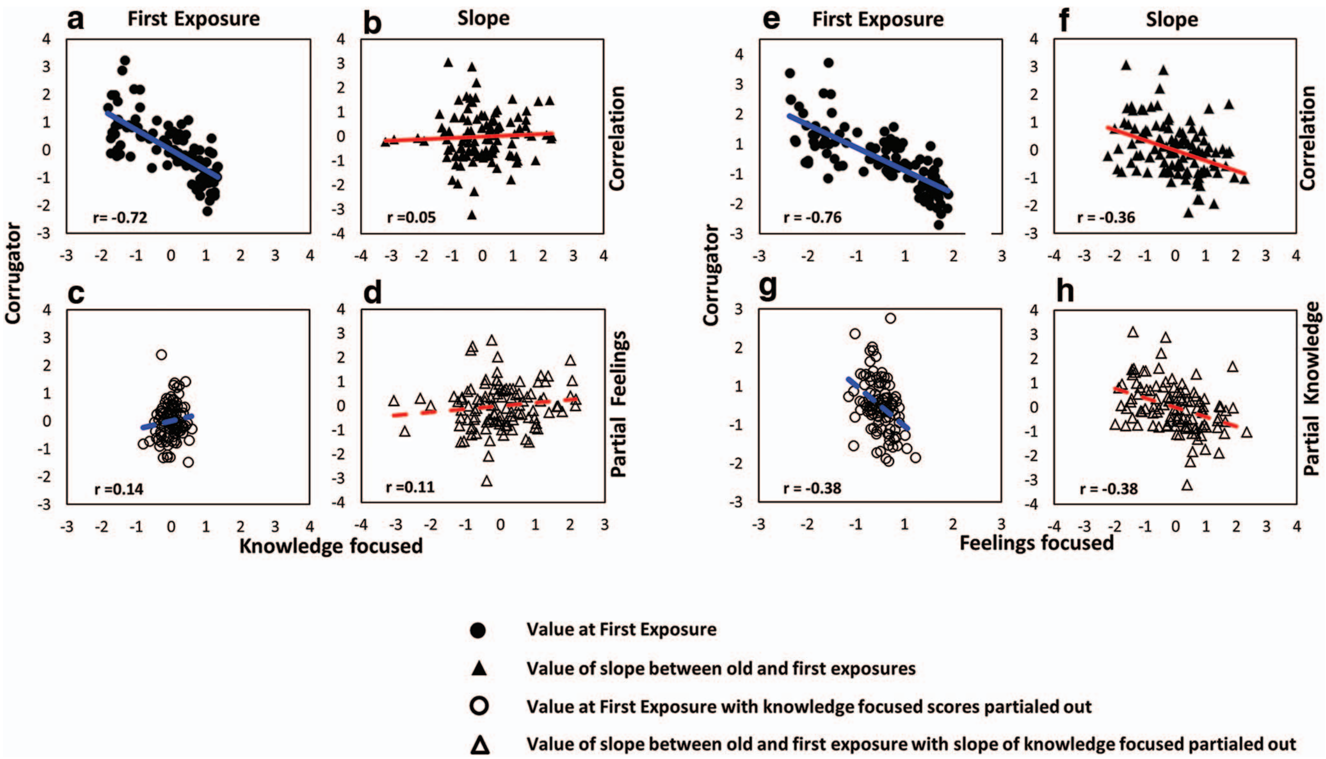

Figure 7. Correlation between (a) corrugator electromyogram(EMG) and knowledge focused self-reports during first exposure (b) the slope (repeated minus new) of corrugator and knowledge focused self-reports (c) corrugator EMG and knowledge focused self-reports during first exposure when feelings-focused self-reports are partialed out (d) the slope of corrugator and knowledge focused self-reports when feelings-focused self -reports are partialed out correlation between (e) corrugator EMG and feelings-focused self-reports during first exposure (f) the slope (repeated minus new) of corrugator and feelings focused self-reports (g) corrugator EMG and feelings-focused self-reports during first exposure when knowledge -focused self -reports are partialed out (h) the slope of corrugator and feelings-focused self-reports when knowledge-focused self -reports are partialed out. See the online article for the color version of this figure.

and knowledge-focused reports is reduced (from $r_{corrugator,knowledge} = .45$) to $r_{(corrugator,knowledge)feelings} = .13$, *ns*, and in the same vain, when knowledge-focused reports are partial out, the correlation between mean heart rate and feelings-focused reports is reduced (from $r_{corrugator,feelings} = .46$ to $r_{corrugator,feelings)knowledge} = .06$, *ns*).

Dissociation between semantic and affective components with repeated exposure. Supporting the divergent effect of repeated exposure on semantic and affective components, the slop of heart rate activation change from novel to repeated stimuli is significantly negatively associated with feelings-focused reports, $r = -.17$, $p < .04$, one-tailed but not with knowledge-focused reports, $r = .09$, *ns*. Moreover, in contrast to first exposure and supporting the dissociation between affective and semantic components with repeated exposure, controlling variance related to change in knowledge-focused reports does not reduce the association between mean heart rate change and feelings-focused reports, $r = -.17$, $p < .05$, one-tailed.

Discussion

Experiment 1 examined the potential dissociation between two modes of valence, affective and semantic. We hypothesized that measures of affective valence will demonstrate habituation with repeated exposure while measures of semantic valence will not. Analyzed from both frequentist and Bayesian perspectives, and supported with correlational statistical control analysis, the results of Experiment 1 suggest that although highly correlated within the emotional response, affective and semantic valence are different psychological constructs that obey different rules. Specifically, measures that are more related to affective valence (i.e., feelings-focused reports, heart rate, and facial EMG of corrugator and zygomaticus) were attenuated with repeated exposure to stimuli, while measures that are more related to semantic valence (i.e., knowledge-focused reports and the congruency effect of the affective Simon task) did not.

However, there is a potential alternative explanation to the finding that the affective Simon's congruency effect is immune to the repeated exposure manipulation. Remember that in Experiment 1, pictures were repeatedly presented in the first phase of the study. In the second phase, the repeated pictures were presented within the affective Simone task together with novel pictures. Since pictures were not repeatedly presented within the context of the affective Simon task, it is possible that the new context of the affective Simon task "washed out" the repeated exposure effect. As a consequence, the emotional response reemerged and no

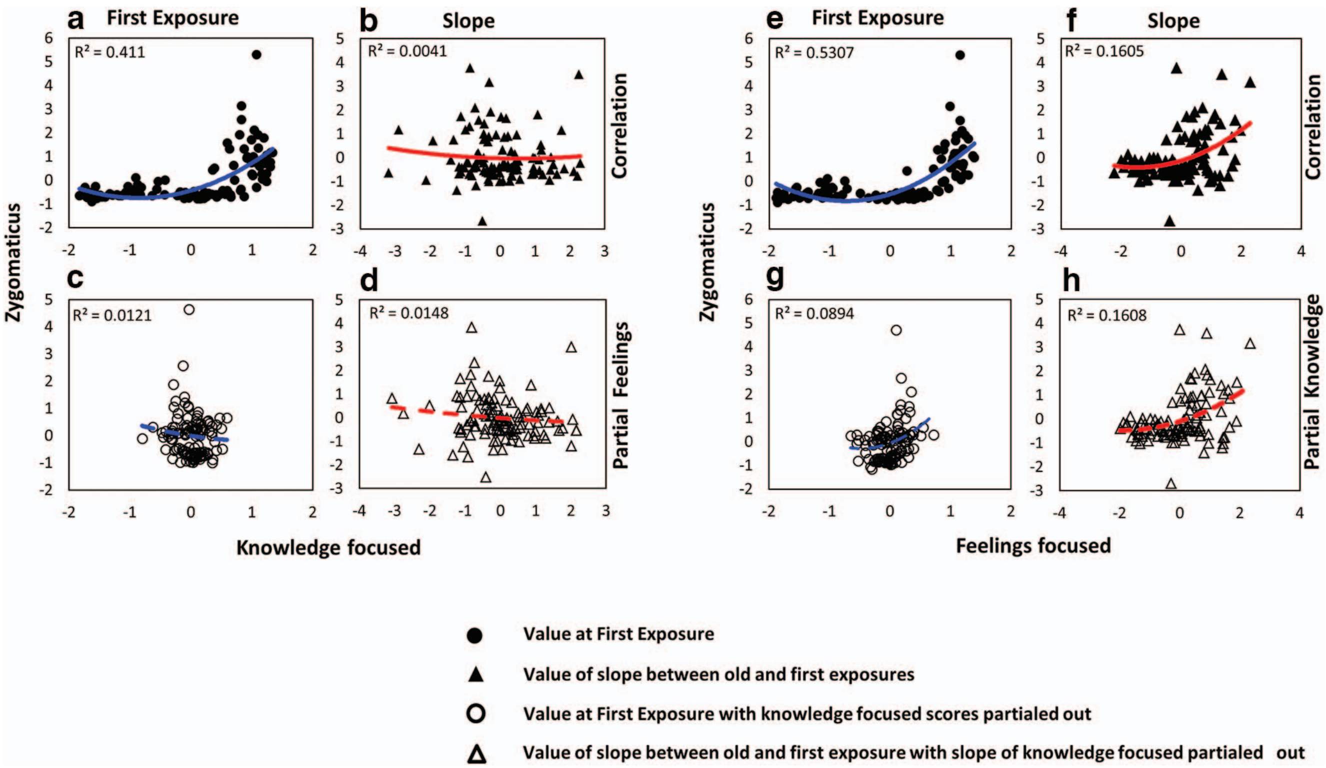

Figure 8. Correlation between (a) Zygomaticus electromyogram (EMG) and knowledge focused self-reports during first exposure, (b) the slope (repeated minus new) of Zygomaticus and knowledge focused self-reports, (c) Zygomaticus EMG and knowledge focused self-reports during first exposure when feelings-focused self-reports are partialed out, (d) the slope of Zygomaticus and knowledge focused self-reports when feelings-focused self -reports are partialed out. Correlation between, (e) Zygomaticus EMG and feelings-focused self-reports during first exposure, (f) the slope (repeated minus new) of Zygomaticus and feelings focused self-reports, (g) Zygomaticus EMG and feelings-focused self-reports during first exposure when knowledge -focused self -reports are partialed out, and (h) the slope of Zygomaticus and feelings-focused self-reports when knowledge-focused self-reports are partialed out. See the online article for the color version of this figure.

difference in congruency effect was found between repeated and new pictures. Experiment 2 was designed to address this concern.

Experiment 2

In Experiment 2 pictures were repeatedly exposed within the context of the affective Simon task—participants were presented with six blocks, in the first four blocks the same pleasant, unpleasant and neutral pictures were repeated and in the last two blocks, a new set of pictures was introduced. In addition, we split the novel set and introduced it in the last two blocks in order to minimize the effects of surprise. Finally, to avoid semantic satiation (e.g., Smith & Klein, 1990), we used a different set of responses ("positive" vs. "negative", "happy" vs. "sad," "good" vs. "bad") in different blocks.

Method

Participants. Thirty undergraduate students (19 women) from University of Haifa participated in this study, ranging in age from 19 to 43 ($M = 23.29$, $SD = 4.68$). The participants received either course credit or monetary compensation for their participation. All participants had normal or corrected-to-normal vision.

Stimuli. Seventy-two pictures were selected for this task (24 pleasant, unpleasant and neutral). The stimuli were selected from those used in Experiment 1, only this time, two lists of stimuli were required: one for repeatedly presented stimuli and one for new stimuli.

Design and procedure. Participants were tested individually in a quiet room. Upon arrival, they were asked to sign a consent form and were seated approximately 60 cm from the computer monitor.

Affective Simon. In this task, two lists of 36 pictures each, were presented in a counter balanced manner as either "repeated pictures" or "novel pictures." In the first four blocks, the 36 "repeated pictures" were presented four times in each block. In addition, half of this repeated set (18 pictures) was presented four times during the fifth block, and half during the sixth block. A set of 36 novel pictures were introduced, half (18 pictures) in the fifth and half in the sixth block. Thus, 18 repeated and 18 novel pictures were presented four times in the fifth and sixth blocks. We split the novel set and introduced it in the last two blocks in order to minimize the effects of surprise. Task was identical to the one is Experiment 1, except that in this experiment, in addition to using "positive" and "negative" as a response, we used "happy" and "sad" and "good" and "bad" in different blocks. Each pair was used twice during the experiment in a counter balanced manner to rule out semantic satiation.

Feelings-focused self-reports. Reported experienced feelings were collected at two time points using the feelings-focused protocol identical to the one used in Experiment 1. The first report was collected right after the first affective Simon block, and the second after the sixth block.

Preprocessing and data reduction.

Self-report. The two unipolar self-reports scores of pleasure and displeasure were converted into a single bipolar valence score (positive minus negative) for the purpose of fluency of reading the data analysis (Kron et al., 2015; Larsen et al., 2003).[5]

Affective Simon. Prior to the analysis, we excluded trials in which the microphone malfunctioned (3%) and trials with RTs shorter than 300 ms and longer than 2,000 ms (2%). Only correct trials were analyzed. Overall, 5% of trials were excluded.

Results

Self-report.

Manipulation check. To make sure that pictures selected for this task elicited pleasant and unpleasant feelings, we compared the self-reported feelings between pleasant and unpleasant pictures after the first block, and between novel pleasant and unpleasant pictures after the sixth block. The difference between pleasant and unpleasant pictures after the first block was significant, $t(29) = 10.53$, $p < .0001$, Cohen's $d = 3.443$. Pleasant pictures were rated as more pleasant ($M = 3$, $SD = 1.99$) than unpleasant pictures ($M = -3.91$, $SD = 2.03$). Similarly, the difference between pleasant and unpleasant novel after the sixth block was also significant, $t(29) = 10.12$, $p < .0001$, Cohen's $d = 3.383$.

Habituation. Pattern of habituation was examined by the difference in self-reports between (a) reports collected after the first block versus reports about repeated pictures collected after the sixth block, and (b) reports of novel pictures collected after the sixth block versus reports of repeated pictures collected after the sixth the block.

As before, the latter was conducted to rule out general fatigue accounts of habituation. As expected, following repeated exposure, self-reported unpleasant feelings attenuated (from $M = -3.91$, $SD = 2.03$ to $M = -3.25$, $SD = 1.79$), $t(29) = 2.81$, $p < .01$, Cohen's $d = -.349$. The difference between last presentation of unpleasant pictures and novel pictures ($M = -3.98$, $SD = 2.10$) was also significant, $t(29) = 2.88$, $p < .01$, Cohen's $d = -.378$.

As expected, following repeated exposure, self-reported pleasant feelings attenuated (from $M = 3$, $SD = 1.99$ to $M = 2.57$, $SD = 2.08$), $t(29) = 1.77$, $p < .05$ (one-tailed), Cohen's $d = .212$. The difference between last presentation of pleasant pictures and novel pictures ($M = 3.13$, $SD = 2.11$) was also significant, $t(29) = 2.30$, $p < .05$, Cohen's $d = .269$, indicating that the attenuation was not because of general fatigue.

Affective Simon. Accuracy was very high (mean accuracy = 98%) and in the expected directions, although not all effects reached statistical significance. It is important that there was no indication for speed–accuracy trade-off.

Correct mean RTs for congruent and incongruent trials in the different blocks are presented in Figure 9. To test the effect of repeated exposure on the congruency effect, the difference in the congruency effect between first and last blocks was examined via an ANOVA with congruency (congruent, incongruent) and exposure (first block/last block) as within participant factors.[6] The main effect of congruency was significant, $F(1, 29) = 20.86$, $p < .0001$, $\eta_p^2 = .418$. Response times were significantly faster to congruent ($M = 712.51$, $SD = 100.89$) than incongruent ($M = 747.19$, $SD = 110.78$) condition, $t(29) = 4.57$, $p < .0001$, Cohen's $d = .327$. Critically, however, as can be seen in Figure 9, the interaction between congruency effect and exposure was not significant, $F < 1$, indicating no change of the congruency effect with repeated exposure.

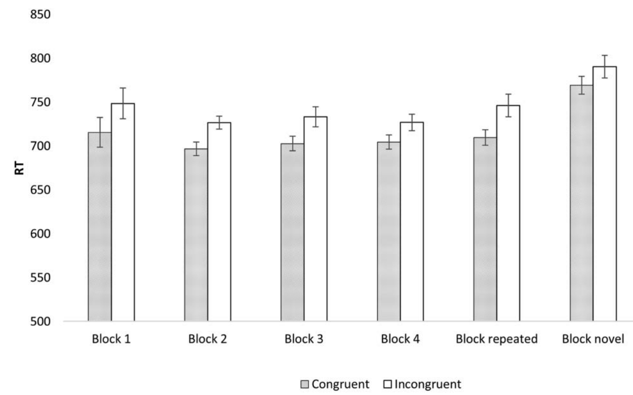

Figure 9. Results for the affective Simon task. Mean reaction times (RTs) for congruent and incongruent conditions, for the same repeated pictures in the first 4 blocks, and for repeated and novel pictures in the fifth and the sixth blocks (averaged, see text for details). Error bars depict 1 *SEM*.Assaf Kron, Department of Psychology and Institute of Information Processing and Decision Making,Assaf Kron, Department of Psychology and Institute of Information Processing and Decision Making,

We next test the potential habituation of the congruency effect by comparing congruent and incongruent trials between previously seen and novel pictures within the two (same) last blocks. A repeated measures ANOVA was performed on congruency and exposure within fifth and sixth blocks. The main effect of congruency was significant, $F(1, 29) = 9.78$, $p < .01$, $\eta_p^2 = .252$. Response times were significantly faster to congruent ($M = 739.34$, $SD = 105.33$) than incongruent ($M = 768.01$, $SD = 130.78$) condition, $t(29) = 3.13$, $p < .01$, Cohen's $d = .242$. The main effect of exposure was also significant, $F(1, 29) = 57.72$, $p < .0001$, $\eta_p^2 = .666$. Response times to repeated pictures ($M = 727.76$, $SD = 109.78$) was faster than to novel pictures ($M = 779.59$, $SD = 124.83$). As expected, the congruency effect did not attenuate with repeated exposure, and if anything, it was larger for the repeated pictures than for the novel ones, $F(1, 29) = 1.99$, $p < .17$, $\eta_p^2 = .07$ (see Figure 9 and SOM4 for Bayesian analysis).

Discussion

Critical to the distinction between affective and semantic valence is that semantic valence should not demonstrate habituation with repeated exposure. The finding that the affective Simon's congruency effect is immune to the repeated exposure manipula-

[5] There was no difference in the pattern of results obtained by using the two unipolar scales in the analysis

[6] Last exposure was calculated as previously seen pictures during the fifth and sixth blocks.

tion, observed in Experiment 1 and taken as indicating no habituation for sematic valence, could have been accounted for by an alternative explanation. Namely, pictures were repeatedly presented in the first phase of the study and not within the affective Simon task. As a consequence, the change in context itself might have eliminated the influence of repeated exposure, accounting for the lack of habituation of the affective Simon effect. To rule out this alternative account, participants in Experiment 2 were repeatedly presented with the same pictures within the affective Simon task. Nonetheless, the results, analyzed from both frequentist and Bayesian perspectives, clearly showed no decrease in the congruency effect, replicating the results of Experiment 1. As such, the present results demonstrate that the lack of habituation of the affective Simon effect obtained in Experiment 1 is clearly not because of the change of context. Taken together, the results of Experiments 1 and 2 provide strong evidence in favor of the distinction between affective and semantic valence.

General Discussion

The aim of this work was to unfold the potential distinction between two fundamental modes of valence: affective valance—the valence of emotional response, and semantic valence—stored semantic knowledge about valence. The logic of the current investigation was that repeated exposure to a stimulus provides the right window to demonstrate the dissociation between them.

The results of our study show that affective valence is susceptible to habituation when the same stimuli are repeatedly presented, whereas repeated presentation has no effect on semantic valence, demonstrating that these two modes of valence obey different rules. Specifically, measures that are associated with affective valence (i.e., feelings-focused self-reports, facial EMG, and heart rate) attenuate with repeated exposure of the stimuli, whereas measures that are associated with semantic valence (i.e., knowledge-focused self-reports, congruency effect of affective Simon task) do not. Note that in this study, habituation was measured by comparing the self-reported value of the same picture presented for the first and for the sixteenth time and by comparing self-reported values between the habituated pictures (sixteenth presentation) and a set of novel pictures. Both measures yielded a habituation pattern, suggesting that the effect was not because of general fatigue.[7]

Self-reports about valence differed as a function of whether the participants were requested to report about their own feelings, or about the valence of the stimulus. Reports of experienced emotional feelings were sensitive to repeated presentation: Participants reported lower pleasure and displeasure after the same picture was repeatedly presented. However, when reporting about the valence of the stimulus (i.e., semantic valence), the reported value was not affected by the repeated presentation. The latter finding was supported both by frequentist and Bayesian analyses.

Part of the challenge in demonstrating the dissociation between affective and semantic valence is that they assumed to be highly correlated within the emotional response (e.g., Scherer, 1984). Indeed, our correlational analysis showed a strong association between feelings-focused and knowledge-focused reports, but only during the first exposure. Critically, this correlation diminished with repeated exposure. The same pattern was obtained when inspecting the association between self-reports and physiological measures. For example, both feelings-and knowledge-focused self-reports were associated with EMG activation, but only feelings-focused reports remained correlated following repeated exposure.

Both the activation of facial muscles and heart rate were affected by repeated presentation. The activation of zygomaticus major was highest during the first presentation of pleasant stimuli and during a presentation of novel, previously unseen pleasant stimuli in the last block of the habituation task. Similarly, the activation of corrugator supercilii was highest during first presentation of unpleasant stimuli and during presentation of new unpleasant stimuli in the last block. Habitation pattern was also evident for heart rate. Heart rate deceleration was mostly evident during the first presentation of unpleasant pictures and during presentation of new unpleasant pictures. This pattern resembles previous studies that demonstrated heart rate deceleration during emotional picture viewing, which was most pronounced for unpleasant as compared with pleasant or neutral pictures (e.g., Bradley et al., 2001; Lang et al., 1993; Pollatos, Herbert, Matthias, & Schandry, 2007).

Given our assumption that the congruency effect of the affective Simon task is semantic in nature, we hypothesized no habituation with repeated exposure. Indeed, the results support our hypothesis. Performance in the "affective" Simon task showed similar congruency effects in response to habituated and to newly presented stimuli in Experiment 1, was replicated in Experiment 2, where repeated exposure was embedded within the affective Simon task and was supported by both frequentist and Bayesian analyses.

The current work aimed to provide a theoretical and empirical distinction between two modes of valence. While variations of the distinction between affective and semantic valence and proxies to this distinction are postulated in the taxonomy of many models of emotion (e.g., Lazarus & Smith, 1988; Robinson & Clore, 2002b; Roseman & Smith, 2001; Schaefer et al., 2003;), the empirical evidence that supports such distinction is scarce. For instance, the proposed dissociation can be compatible with what was termed *core affect* as opposed to "affective quality" (Russell, 2003, 2005). Core affect refers to the dimensions of valence and arousal that are thought to characterize the flow of human experienced feelings (and its physiological correlates), whereas "affective quality" is a property of the stimulus and is reminiscent of what we term "semantic valence." Thus, variations of the distinction between affective and semantic have been postulated, our study provides a paradigm to test, and the much needed empirical support for, this theoretical distinction.

Perhaps the most important implication of the present findings of the dissociation between affective and semantic valence is that valence is not a monolithic concept. Although measures that reflect positivity and negativity are usually placed under the same conceptual umbrella (i.e., "valence"), our study shows that valence

[7] Previous findings demonstrate that under certain conditions, repeated exposure to stimuli result in an increase of positive feelings, what is termed a "mere exposure effect." However, the mere exposure effect is traditionally demonstrated by showing that initially neutral stimuli become more favorable following repeated exposure. The effect is eliminated when the repeated stimuli have an affective content, possibly because the habituation of emotional response has a stronger effect that mere exposure (Zajonc, 1968). Consequently, because of the fact that the experimental stimuli in the current study were selected to elicit pleasure and displease, a mere exposure effect was neither expected nor obtained.

may refer to at least two distinct psychological constructs: emotional response and semantic knowledge. This distinction is highly relevant to both research and theory of emotion, semantic knowledge, and their interaction.

There are at least two factors that determine whether the experimental paradigm and the findings obtained reflect affective or semantic valence: (a) the question the researcher attempted to answer, and (b) the question the participant attempted to answer. Without careful control, it is difficult to infer whether the self-reported values are based on affective or semantic valence. For example, when interested in affective valence, one researcher might present a picture of a puppy and ask participants to evaluate how positive their feelings are, whereas another researcher asks participants to evaluate how positive the picture of a puppy is. Allegedly, both questions refer to valence, but actually, in the former, participants are likely to use affective valence as an indicator of how positive they feel, whereas in the latter, they may rely on semantic valence (knowing that puppies are positive even if they have no feelings in response to the picture). The fact that both affective and semantic valence rely on the same metric (i.e., the valence scale) and their high degree of correlation (Folkman et al., 1986; Zajonc, 1980), makes the dissociation between the two particularly challenging.

Thus, without an explicit distinction between affective and semantic valence, experimental results might be difficult to interpret. Today, many tasks that are interpreted as affective in nature, actually involve categorization of the valence of the stimuli and/or cognitive conflict (e.g., De Houwer, 1998; Klauer & Musch, 2003), hence, may reflect semantic valence. For instance, when findings show that people are faster to make a categorization based on the nonaffective category of the stimulus (whether it is an animal or an object) than on the affective category (whether positive or negative; Itkes & Mashal, 2015; Nummenmaa, Hyönä, & Calvo, 2010)—Do these findings reflect the precedence of semantic over affective process or do they reflect the precedence of one semantic category over another?

Endorsing feelings-focused protocols bears important advantages to the investigation of emotions. Self-reports of valence are critical in emotion research as a measure of emotional feelings (Barrett, Mesquita, Ochsner, & Gross, 2007), as means to allocate stimuli to experimental conditions by standardized norms (Lang et al., 1997), and as means to model physiological (e.g., Lang et al., 1993) and neural (Phan et al., 2003) signals. In addition, the potentially divergent effects of repeated exposure on semantic and affective modes of valence can explain some inconsistent effects of repeated exposure on self-report of feelings. For example, in Bradley et al.'s (1993) study, self-reports of arousal showed attenuation, while self-reports of valence did not. In other cases, self-reports of valence were attenuated only with negative stimuli and not with positive stimuli (Codispoti, Ferrari, & Bradley, 2006). We suggest that these inconsistencies in habituation patterns of self-reports are at least partially related to the fact that some reports are more prone than others to include semantic evaluations that do not change with habituation. Indeed, the results of our study show that with feelings-focused instruction, self-reports of both pleasure and displeasure attenuated with repeated exposure.

Furthermore, the empirical dissociation between affective and semantic valence can be relevant to two discussions revolving around the interrelations between- and theoretical meaning of-different measures of attitudes. The first is concern the lake of consistent strong correlations between implicit and explicit measures of attitudes that raise the issue of whether they share the same underlying construct (Gawronski & Bodenhausen, 2007). To the extent that at least part of the distinction between implicit and explicit measures can be explained in terms of semantic knowledge and emotional response, then, our results suggest that they might reflect different underlying structures. A second discussion concerns the validity of the componential view of attitudes. As mentioned previously, the structure of attitudes is often assumed to be composed of affective, cognitive, and behavioral determinants (see Eagly & Chaiken, 1993, 1998). The empirical evidence in favor of the componential structure is inconclusive. While some studies find support for both affective and cognitive determinants (e.g., Breckler, 1984; Breckler & Wiggins, 1989; Crites et al., 1994; Eagly, Mladinic, & Otto, 1994; Haddock, Zanna, & Esses, 1993; Ostrom, 1969), other analyses failed to support a multicomponent model (e.g., Bagozzi, 1978; Breckler & Wiggins, 1989). The results of the current work suggest that fine-grained parsing of the attitude space into semantic and affective representation of valence, together with carful instructions of self-reports and experimentally controlling repeated exposure, could demonstrate more consistent and theoretical meaningful intercorrelation between affective- and semantic- laden measures.

Coda

In this work, we propose a distinction between two modes of valence: affective and semantic. Affective valence refers to valence of the emotional response, while semantic valence refers to the knowledge about the valence of the stimulus. While this distinction is often postulated and discussed in the literature, the available empirical data on emotion taxonomy are scarce. The current work provides a direct empirical support for this distinction. Furthermore, it has the potential to steer future research as well as clarify the understanding of previous findings in both affective science and attitude research.

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Received February 14, 2016
Revision received December 30, 2016
Accepted February 1, 2017 ■