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emotion review

Emotion Review
Vol. 11, No. 4 (October 2019) 283–293

ISSN 1754-0739
DOI: 10.1177/1754073919868759
https://journals.sagepub.com/home/emr

Affective and Semantic Representations of Valence: A Conceptual Framework

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Abstract

The current article discusses the distinction between affective valence—the degree to which an affective response represents pleasure or displeasure—and semantic valence, the degree to which an object or event is considered positive or negative. 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. Recent work suggests that what might seem to reflect a monolithic structure of valence has at least two different, confounding underlying sources, affective and semantic, that are fundamentally distinct, dissociable, and that obey different, recognizable rules. The current work discusses this distinction and provides implications for affective science from both the theoretical and the empirical perspective.

Keywords

affect, affective valence, emotional response, semantic valence

> "We can assess the lack of (scientific) progress by the degree of ambiguity of our most popular terms."
>
> (Tulving, 1972, p. 381)

The term "valence" is commonly used to describe the quality of being desirable or aversive, pleasant or unpleasant (Barrett, 2006). The starting point of the following argument is that humans are able to index the valence of events in at least two different ways: firstly, by activation of the affective response profile (e.g., experiencing negative feelings in response to an event X), and secondly, by semantic representation of the event (e.g., knowing that event X is negative). There is a difference between the experience of negative *feeling* and having a sense of *knowing* that something is negative. Accordingly, one might find oneself seeing a picture of a funeral in the newspaper and having a full-blown emotional response with autonomic changes, expressions, and bursts of feelings. Another person might look at the same picture and know that funerals are usually sad and negative events, but still have no strong affective response, if any at all.

The term *valence* is used by emotion researchers to refer to both phenomena—as a value indexed by an emotional response (henceforth *affective valence*) and as semantic knowledge about the value of an event (henceforth *semantic valence*). But using the same term for both affective and semantic valence quite often reflects and/or creates confusion between the two; for example, when completely semantic tasks are interpreted as reflecting affective processes. The main aim of the following review is to clarify this distinction and provide a theoretical and empirical starting point for future research. In the first part, we will provide working definitions of affective and semantic valence as two separate constructs. Next, we will map the relationship between these distinctions onto similar taxonomies previously suggested in the literature. Then we will suggest that the two modes of valence are empirically dissociable and abide by different rules. We will also suggest a way to decide if a measure reflects a more semantic or affective component. Finally, we will discuss the importance of distinguishing between the two modes of valence, both in empirical research and in theory, and suggest potential directions for future research.

Working Definitions

Affective valence is a property of an emotional *response* and semantic valence is factual *knowledge* about the valence of an object or event. While the first consists of a change in response channels, the second is conceptual knowledge about the valence

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of the event. Accordingly, the theoretical distinction between affective and semantic valence rests on the difference between what constitutes a *response* and what constitutes *semantic knowledge*.

Affective Response

Response is defined here as a change that comes after exposure to a stimulus. The affective response is a profile of changes, such as an increase or decrease in heart rate (e.g., Lang, Greenwald, Bradley, & Hamm, 1993), sweat secretion (Codispoti, Ferrari, De Cesarei, & Cardinale, 2006; Lang et al., 1993) or hormone secretion (Henry, 1986), a shift in facial expression and body postures (e.g., Dael, Mortillaro, & Scherer, 2012; Lang et al., 1993), and changes in feelings (the conscious experience of affect and emotion). Critically, in the affective response, the change, or pattern of changes, indexes the occurrence of an event as desirable or aversive (Dolan, 2002) as well as the degree of arousal (Russell, 1980; but see Kron, Goldstein, Lee, Gardhouse, & Anderson, 2013). For example, a positive affective experience indicates a positive event and a negative affective experience indicates a negative event. In summary, affective valence refers to a response (a change that comes after an event) that indexes that event as desirable or not.

Semantic Knowledge

Traditionally, stored knowledge is divided into two broad categories: episodic and semantic memory (e.g., Schacter, Wagner, & Buckner, 2000; Tulving, 1984, 1993; Wheeler, Stuss, & Tulving, 1997). While episodic memory is composed of knowledge related to a specific event at a particular time and place (e.g., I saw a snake in the garden yesterday, and I felt fear), semantic knowledge refers to general conceptual knowledge about objects and events (e.g., snakes are venomous and therefore negative). Both types of knowledge tap into stored information about valence and thus represent valence in a nonexperiential manner. That is, we argue that it is possible to think and reason about the valence of objects and events without simultaneous full-blown activation of response channels. People can consistently categorize events according to the valence dimension (whether they are positive or negative) without a change in their experienced feelings, facial expressions, autonomic activation, etc.

The ability to represent valence semantically has a clear evolutionary advantage because it enables people to represent the valence of an event in order to plan future behavior and communicate with others without having to experience an emotional response simultaneously. In accordance with the potential advantage, and perhaps the prominent role of semantic representation of valence in decision making and communication, it was suggested that valence is the basic dimension around which the human meaning system is organized (Osgood, 1962). In summary, the term semantic valence refers to a feature of general conceptual knowledge about the valence of an event.

Previous Taxonomies

Variations of the distinction between affective and semantic valence can be found in the taxonomy of many dual-process psychological models, including "cold" versus "hot" emotional processes (Schaefer et al., 2003), "hot" emotional "go" systems versus "cool" cognitive "know" systems (Metcalfe & Mischel, 1999), self-immersing versus self-distancing perspectives (Kross & Ayduk, 2011), impulsive versus reflective systems (Strack & Deutsch, 2004), cognitive appraisal versus feeling (Lazarus & Smith, 1988; Roseman & Smith, 2001), and cognitive and affective components of attitudes (Eagly & Chaiken, 1993, 1998). The conceptualizations most similar to our distinction are those of core affect versus affective quality (Russell, 2003) and experiential versus nonexperiential knowledge (Robinson & Clore, 2002a).

Core Affect Versus Affective Quality

Russell suggests a distinction between *core affect* and *affective quality* (Russell, 2003, 2005). Core affect is defined as a nonreflective flow of feelings that can be mapped onto the dimensions of valence and arousal. Affective response is characterized by a change in core affect. For instance, when coming across a snake in the garden, the pleasant, low-arousal core affect might rapidly change into an unpleasant, high-activation (arousal) state. Unlike core affect, affective quality is not a feeling of pleasure/displeasure/activation, but rather information about the valence of the object or the potential of an object to change core affect. Russell suggests that affective response (change in core affect) and knowledge about affect (affective quality) can be discussed in the same terms (i.e., valence and arousal) and emphasizes the importance of distinguishing between the two. The distinction we use between valence of *response* (affective valence) and *knowledge* about valence (semantic valence) is inspired by and in agreement with Russell's taxonomy, but we chose not to adopt Russell's terminology (instead we use affective and semantic valence). There are two reasons for this. Firstly, we suggest defining affective quality in terms of knowledge. The term "knowledge" is based on the theory of human cognition (e.g., Markman, 2013; Patterson, Nestor, & Rogers, 2007; Rosch, Mervis, Gray, Johnson, & Boyes-Braem, 1976) and makes it possible to break down the term "affective quality" further and ask how valence is represented within different types of human knowledge systems, such as semantic and episodic knowledge. Secondly, the terms "core affect" and "affective quality" are loaded with other assumptions and meanings (Russell, 2003) that may not apply here.

Experiential Versus Nonexperiential Knowledge

Robinson and Clore (2002b) make a distinction similar to affective and semantic valence when attempting to characterize the sources of information participants rely on when providing self-reports. They distinguish between three potential sources of information for self-reports: experiential, episodic, and semantic.

What Robinson and Clore term *experiential knowledge* is based on feelings that one experiences in response to an event. Experiential knowledge is assumed to be event-related (i.e., elicited by a specific event) and time-dependent, in the sense that it is fully accessible only with temporal proximity to the event that caused it. Episodic information is not a representation of feelings, but can be reconstructed by recalling specific details. That is, it is better understood as the episodic memory about the feeling felt during a specific event. The third source of information is semantic information, which according to Robinson and Clore, consists of general factual knowledge, cultural norms, stereotypes, and beliefs about one's own feelings.

What we term affective valence shares commonalities with what Robinson and Clore (2002a) referred to as experiential knowledge. However, in this article the term affective valence refers not only to feelings, but potentially, also to other components of an emotional response, such as autonomic activation and skeletomotor response. The nonaffective component of Robinson and Clore's model consists of both, the episodic and the semantic knowledge. Here we emphasize the semantic aspect but do not rule out that nonaffective representations of valence include both semantic and episodic components.

It is worth noting that not all theoretical accounts of knowledge structure will agree with the potential distinction between experiential and nonexperiential representation of knowledge. For example, according to theories of embodiment, concepts are not merely abstract representations, but they involve simulations of experience (e.g., Barsalou, 1999; Glenberg, 1997; see Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005, for a review of this topic) and action plans (Barrett, 2017) in modality-specific systems. A strong version of embodiment theory implies that the human conceptual system does not involve abstract concepts, and that the representation of a concept *is* the simulation of experience and action plans (Barrett, 2017). According to this version, dissociation between experience and knowledge is not plausible. A weaker context-dependent version of embodied emotion implies that the degree to which emotion-related concepts are represented semantically or, alternatively, involve embodiment, is task-dependent (Niedenthal, Winkielman, Mondillon, & Vermeulen, 2009, see specifically the discussion on Experiment 4; Winkielman, Coulson, & Niedenthal, 2018). This context-dependent version of embodiment permits dissociation between affective and semantic representations of valance.

Although the aforementioned taxonomies provide theoretical foundations to distinguish between affective and semantic representations of valence, there is often a great deal of confusion between the two in empirical research. Next, we will discuss five examples of such confusions: (a) cases in which self-reported data reflect semantic rather than affective information; (b) affective tasks that involve semantic, cognitive conflict; (c) affective tasks that involve semantic categorization; (d) studies that infer the structure of feelings by studying the structure of semantic knowledge; and (e) confusion between facial expressions that reflect semantic knowledge versus facial expressions that occur during the affective response.

Confusing Semantic and Affective Representations of Valence

"Affective" Self-Reports That Reflect Semantic Evaluation

Self-reports about valence are a primary scientific tool for estimating affective feelings, the conscious experience of affect (Barrett, Mesquita, Ochsner, & Gross, 2007). Yet, self-reports might reflect other sources of information, such as expectations, social desirability biases (van de Mortel, 2008), and response biases (e.g., Furnham, 1986). Critically, self-report data often reflect semantic knowledge about valence (Hamzani, Mazar, Petranker, Itkes, & Kron, 2019; Itkes, Kimchi, Haj-Ali, Shapiro, & Kron, 2017; Robinson & Clore, 2002b). In the empirical research of emotion, the goal is often to use self-reports as an indicator of the participants' affective feelings and make sure they are not contaminated by nonaffective components, such as general semantic knowledge about valence. One possible factor that can increase the probability to sample affective valence is collecting self-reports as close as possible to the emotion-eliciting event. Robinson and Clore (2002a, 2002b) emphasized the role of temporal proximity to the emotion-eliciting event. They suggested that when reports are collected during or in short temporal proximity to the emotion elicitation event, the probability of the self-reports reflecting actual feelings is higher. However, if participants are asked to report about an event after time has passed, the report will rely more on episodic or semantic information. According to Robinson and Clore, the reason for the effect of temporal proximity is that the affective experience itself cannot be stored in long-term memory, and when the experience dissipates, participants must then rely on nonaffective episodic or semantic information.

A second factor that can determine whether participants report about their own affective response or semantic valence is how they understand the task. When participants understand that they should report how positive and/or negative the *stimulus* is, they might base their valence ratings on semantic evaluations. However, when they understand the task to be how positive and/or negative their *feelings* are, self-reports might reflect more affective information. For example, Russell and Barret (1999) suggested that core affect is probed by asking participants how they feel right now, while evaluative reactions are probed by asking participants how they feel *about* something.

From our experience in lab experiments, simply asking participants about stimulus versus feelings might not be sufficient, and for an average participant to understand the difference between reporting semantic knowledge and their feelings might be challenging. To this aim, we developed two sets of instruction protocols: (a) feelings-focused self-reports that guide participants to report about internal feelings, as opposed to evaluations based on semantic knowledge, expectations, or beliefs; and (b) knowledge-focused self-reports that guide participants to report on semantic knowledge about the event conveyed by the stimulus (Hamzani et al., 2019; Itkes et al., 2017; Kron, Pilkiw, Banaei, Goldstein, & Anderson, 2015). Initial evidence from our lab supports the validity of feelings-focused and

knowledge-focused reports. In a recent study, we compared the ability of feelings-focused instructions (participants were taught to report feelings and not semantic knowledge), naïve instructions (participants were instructed to report their feelings without the instructions distinguishing them from semantic knowledge), and knowledge-focused instructions (participants were taught to report semantic knowledge and not feelings) to predict facial electromyography (EMG), heart rate, and electrodermal changes in response to pictorial emotional stimuli (Hamzani et al., 2019). We found a clear advantage of feelings-focused over knowledge-focused instructions in predicting both signal intensity and activation status of the physiological response, whereas naïve instructions fell in between.

A third variable that can potentially affect accessibility to feelings is the magnitude of the emotional response (Levenson, 2003). When the emotional response is low in intensity, the detection of feelings becomes difficult (Karmon-Presser, Sheppes, & Meiran, 2018) and the evaluation is based more on nonaffective properties, such as the semantic meaning that is still clear and easily retrieved (Itkes et al., 2017). In such cases, the accessibility model (Robinson & Clore, 2002a) predicts that participants tend to rely on nonaffective valence.

"Affective" Tasks That Involve Semantic Cognitive Conflict

A second type of confusion between semantic and affective modes of valence can be found in a category of tasks that involve semantic conflict. Over the years, "affective" variations of semantic tasks have become common (De Houwer, 2003; Greenwald, McGhee, & Schwartz, 1998; Greenwald, Nosek, & Banaji, 2003; Hermans, De Houwer, & Eelen, 1994; Klauer & Musch, 2003; Otten & Wentura, 1999). For example, consider the affective version of the semantic Simon task (De Houwer, 2003; De Houwer, Crombez, Baeyens, & Hermans, 2001). The affective Simon task is usually interpreted as a measure of automatic affective processing (De Houwer et al., 2001; De Houwer & Eelen, 1998) or automatic affective associations (Huijding & de Jong, 2005), which is contrasted with the semantic version of the Simon task (De Houwer & Eelen, 1998). To understand the semantic nature of the affective Simon task, let's first consider the semantic (nonaffective) version of the task. In the semantic Simon task, participants are instructed to respond by saying "animal" or "occupation," depending on whether the presented word was written in Dutch or English—that is, the language of the word is a relevant feature to the response. However, the irrelevant feature, the word's meaning, could also vary and convey either an animal or an occupation. This created a congruent condition in which the participant's response and the irrelevant feature matched, and an incongruent condition in which the participant's response and the irrelevant feature did not match. Results showed a strong congruency effect—participants responded faster when the irrelevant feature was congruent with the category of the response than when the irrelevant feature did not match (De Houwer & Eelen, 1998). The semantic Simon task is usually interpreted as a task that involves cognitive conflict, as it results in a semantic overlap between an irrelevant dimension of the stimulus and a dimension of the response (De Houwer & Eelen, 1998; Kornblum, Hasbroucq, & Osman, 1990). In the "affective" version of the Simon task (De Houwer & Eelen, 1994), participants are instructed to respond by saying "positive" or "negative," depending on whether the presented word is an adjective or a noun (relevant feature), but irrespective of whether the word conveys a positive or negative meaning (irrelevant stimulus feature). Similar to the semantic version of the task, results showed a strong congruency effect—participants responded faster when the irrelevant feature was congruent with the category of the response than when it was related to the other category.

Here we suggest that the fact that the affective Simon task uses affective words does not justify defining it as an affective task, and in both cases the source of the congruency effect is a semantic overlap between the meaning of the response and the meaning of the irrelevant feature. Supporting this view, in a sophisticated line of studies, Duscherer, Holender, and Molenaar (2008) suggested that the general principles that apply to the semantic version of the Simon task (e.g., Hommel, 1993; Lu & Proctor, 1995, 2001) can also explain reaction-time patterns in the affective Simon task; specifically, that the magnitude of the Simon effect depends on both the relative speed of processing the relevant and irrelevant information and on the relative strength of the semantic relationship between the irrelevant attribute and the response. They concluded that

> [T]here is no ground for distinguishing between a semantic form of the Simon effect based on the irrelevant denotation of the stimuli in terms of their semantic category (De Houwer & Eelen, 1998) and an affective form of the Simon effect based on the connotation of the stimuli in terms of their affective valence (De Houwer & Eelen, 1998). (Duscherer et al., 2008, p. 215)

Additional evidence in favor of this interpretation comes from findings that show no modulation of the affective Simon congruency effect by the degree of valence of the stimuli. That is, 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 De Houwer et al., 2001, Experiment 1 vs. Experiment 3).

Similar arguments also exist in regard to the valence version of the Implicit Association Test (IAT). The valence IAT is also a reaction-time task that relies on a congruent and incongruent meaning overlap between irrelevant feature and response that arguably reflects participant's valence attitudes about various concepts (De Houwer, 2001; Greenwald et al., 1998; Greenwald et al., 2003; Mierke & Klauer, 2003; Nosek, Greenwald, & Banaji, 2005). Relevant to the current discussion, one explanation for the IAT effect emphasizes the role of cultural knowledge (Arkes & Tetlock, 2004; Devine, 1989). According to accounts of cultural knowledge, the response pattern in the IAT can be the result of cultural norms (i.e., in our terms, semantic knowledge), even though the effect reflects the stimulus valence (Karpinski & Hilton, 2001; M. A. Olson & Fazio, 2004).

"Affective" Tasks That Involve Semantic Categorization

Perhaps the most prominent example of confusion in tasks that involve semantic categorization but are interpreted as affective can be found in the theoretical discussion about the affective versus cognitive primacy hypothesis. The affective primacy hypothesis posits that in the sequence of information processing, affective response (such as feelings) precedes semantic meaning (e.g., Zajonc, 1980). Contrary to this, the cognitive primacy hypothesis argues that the affective response follows the semantic analysis of the stimuli (e.g., Nelson, 1973; Storbeck, Robinson, & McCourt, 2006). One common paradigm that was used in the literature to support one hypothesis over the other is the affective versus semantic classification task (e.g., Nummenmaa, Hyönä, & Calvo, 2010; Spruyt, De Houwer, Hermans, & Eelen, 2007). In this task, participants are instructed to respond as fast and as accurate as possible to either the affective category of the stimulus (positive vs. negative) or the semantic category of the stimulus (e.g., dog vs. snake). The latency of reaction times is usually taken as evidence for either the affective or the semantic primacy hypothesis (e.g., Lai, Hagoort, & Casasanto, 2012). However, *stimulus evaluation* as either positive or negative, as discussed throughout this article, might not require participants to experience any *affective response*. Moreover, even if the experimental stimuli evoke an affective response, it does not mean that the speeded classification is based on the participant's affective response.

Another version of the affective versus cognitive primacy hypothesis is currently at play in the literature on olfactory cognition (Khan et al., 2007; Majid, Burenhult, Stensmyr, de Valk, & Hansson, 2018; Olofsson, Bowman, & Gottfried, 2013; Olofsson, Bowman, Khatibi, & Gottfried, 2012). A debate has evolved around how, and in what order, information about object identity versus valence is perceived from olfactory input. Some of the tasks that are used to decide between the alternatives are reaction-time categorization tasks that are very similar to the tasks used in the affective versus cognitive primacy hypothesis. Here participants are presented with an odor and are asked to perform a categorization task according to its object identity or valence. Similar to the case of affective versus cognitive primacy hypothesis, it is not clear that valence categorization reflects the experience of valence (affective valence) and does not reflect the semantic categorization of valence (semantic valence). In that case, any difference in reaction time can reflect parameters that are related to difficulty in conceptual categorization—for example, valence might be slower than object identification because valence is a superordinate category.

The Structure of Affective Experience

The discussion about the dimensional structure of conscious experience of affect is a fourth example that demonstrates a potential confusion and vacillations between semantic and affective interpretations of valence. There is a history of long-lasting debates over the past 30 years about the structure of affect, and the most prominent model is the bipolar valence arousal model (e.g., Lang et al., 1993; Russell & Barrett, 1999). The discussion has been fueled by questions such as what is the optimal number of dimensions that map the affective space (Russell, 1980)? What is the best way to model valence? Is it bipolar (ranges from pleasant to unpleasant) or unipolar (consists of two separate unipolar axes of pleasant and unpleasant valence; Cacioppo, Gardner, & Berntson, 1997; Larsen, McGraw, & Cacioppo, 2001)? Do mixed emotions exist (Itkes, Eviatar, & Kron, 2019; Larsen & McGraw, 2011)? And is arousal separable from intensity of valence (Kron et al., 2013; Kron et al., 2015)?

The majority of the work about the dimensional structure of affect has measured implicit or explicit *knowledge* about valence, but has been interpreted as reflecting the structure of affect. This is reflected in the various types of categorization tasks used, such as similarity ratings of facial expressions (e.g., Abelson & Sermat, 1962; Cliff & Young, 1968; Engen, Levy, & Schlosberg, 1957, 1958; Royal & Hays, 1959; Schlosberg, 1954; Shepard, 1962); affective structure of semantic differentiation in ordinary language (e.g., Averill, 1975; Osgood, May, & Miron, 1975; Snider & Osgood, 1969); the structure of affective words (Bush, 1973; Dittmann, 1972; Russell, 1980; Russell & Mehrabian, 1974; but see Borgatta, 1961; Clyde, 1963; Izard, Bartlett, & Marshall, 1972; Nowlis, 1965, for more dimensions); and nonverbal cues (Mehrabian, 1972; Mehrabian & Ksionzky, 1974). Allegedly, an additional line of studies used measures that reflect more affective aspects of valence by asking participants to report their conscious experience more directly (Barrett & Russell, 1998; Russell & Mehrabian, 1977; Yik, Russell, & Barrett, 1999). Critically, most of the aforementioned research, both studies that measured knowledge and those that asked to report feelings, used latent variables analysis strategies (such as factor analysis, multidimensional scaling, principal component analysis, structural equation modeling) that mainly rely on semantic relationships between words or pictures. Hence, even studies that relied on self-reports of feelings but used latent variable analyses, ultimately rely on the semantic relationship between items.

The main assumption of this literature is that the structure that emerges from semantic relationships between items reflects the structure of conscious affect. Based on this assumption, stimulus pools were standardized according to bipolar valence and arousal scales (Bradley & Lang, 1994). However, interestingly, when participants were asked to report about their own feelings in terms of arousal and valence, and analysis was not based on semantic relationships, the picture that emerged between bipolar valence and arousal was very different. Instead of independence, strong dependency between valence and arousal was found (Bradley, Codispoti, Cuthbert, & Lang, 2001). Consequently, some researchers adopted different versions of the valence arousal model that do not assume independence (Bradley et al., 2001; Kron et al., 2013; Kron et al., 2015).

Facial Response Versus Semantic Knowledge About Facial Response

The fifth example of potential confusion is semantic knowledge about facial expression versus the actual facial behavior during the affective response. Facial changes are traditionally thought to be a component of the emotional response (e.g., Darwin, 1873; Ekman, 1992; Russell, 2003). The study of facial emotion expression and recognition traditionally uses stimuli composed of actors with posed facial expressions (e.g., stimuli from facial expressions sets, such as Pictures of Facial Affect [POFA]: Ekman & Friesen, 1976; NimStim: Tottenham et al., 2009; FACES: Ebner, Riediger, & Lindenberger, 2010). The posed expressions reflect what actors and/or researchers think and believe the emotional facial behaviors should look like. This belief might reflect personal knowledge or cultural norms that constitute semantic knowledge. While facial poses were traditionally interpreted as reflecting the affective response, recent reviews of experiments that examine the real-life facial changes that occur during an affective response call to reconsider traditional knowledge about facial behavior (for reviews, see Fernández-Dols & Crivelli, 2013; Reisenzein, Studtmann, & Horstmann, 2013). While stereotypical knowledge-based facial reactions are usually diagnostic and clear, the actual facial reactions behave differently, in some cases with high intensity show no distinction between positive and negative situations, and in other cases show minimal or no changes at all, even during strong affective responses (Aviezer et al., 2008; Aviezer, Trope, & Todorov, 2012).

Semantic Knowledge Versus Emotional Response: Empirical Dissociation

The previous examples of confusion between affective reaction and semantic knowledge about valence emphasize the importance of finding criteria to decide if, or to what extent, a specific task is affective or semantic. The first step in such a decision is to find a way to empirically dissociate affective and semantic components. The dissociation between affective and semantic representations of valence is challenging since, in real life, they might be highly correlated and involved in a causal relationship: semantic knowledge might determine the affective response (Folkman, Lazarus, Dunkel-Schetter, DeLongis, & Gruen, 1986) and vice versa, the affective experience might color and shape semantic decisions (Schwarz, 2012).

One way to tease apart the two is with the divergent effect of repeated exposure to affective and semantic components. In previous work (Itkes et al., 2017), we hypothesized that manipulating repeated exposure to stimulus will attenuate affective but not semantic valence. The logic underlying this prediction is that affective response consists of 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 that will gradually decrease over time. For this reason, we predict that habituation is expected in the case of time-sensitive affective valence. Indeed, many studies have shown habituation of the affective response, such as those using electromyography (Lang et al., 1993), early heart rate response (Codispoti, Ferrari, & Bradley, 2006; Lang et al., 1993), and components that are related to undifferentiated arousal and orienting responses such as electrodermal activity (Codispoti, Ferrari, De Cesarei, et al., 2006; Lang et al., 1993) and late component of event-related potential (ERP; Codispoti, Ferrari, & Bradley, 2006). Contrary to affective valence, it is unlikely that semantic knowledge will show momentary changes and, hence, is unlikely to exhibit habituation (see related argument in Codispoti, Ferrari, & Bradley, 2006; Schupp et al., 2006). Semantic knowledge is not a response to stimuli, but rather a representation of meaning retrieved from long-term memory. The same way that objects and events do not lose their meaning based on the frequency with which we are exposed to them, we expect no dramatic change in semantic knowledge about valence as a result of repeated exposure (see also Chi & Roscoe, 2002).

Based on the logic that affective valence will go through habituation, but semantic valence will not, we chose the measures that reflect ongoing changes in responses to the stimulus to represent affective valence, and time-insensitive knowledge-based responses to the stimulus as measures of semantic valence. In this study, we specifically chose physiological measures of facial muscle activation (e.g., Bradley et al., 2001; Kron et al., 2013; Lang et al., 1993), heart rate (e.g., Bradley et al., 2001; Lang et al., 1993), and feelings-focused instructions for self-reports as measures of affective valence. Measures representing semantic valence were the congruency effect of the affective Simon task (De Houwer et al., 2001; De Houwer & Eelen, 1998) and knowledge-focused self-reports. In this study, two groups of participants performed a habituation task and an affective Simon task. In the habituation task, a set of affective pictures were repeatedly presented and we compared the attenuation of valence ratings (feelings- and knowledge-focused) as well as measures of physiological response in both groups. In the affective Simon task, congruency effect was compared between habituated and novel pictures. The results suggested that repeated exposure attenuated feelings-focused self-reports, EMG activation, and heart rate, and did not affect knowledge-focused reports and the congruency effect of the affective Simon task (Itkes et al., 2017).

Implications for Research

Next, we present two examples in which the distinction between affective and semantic valence has the potential to explain empirical inconsistencies; the inconsistencies between implicit and explicit measures in attitude research, and the inconsistent effect of repeated exposure on self-reports of feelings.

Inconsistent Findings Between Implicit and Explicit Measures of Attitudes

Valence is a pivotal concept in attitude theory and is present in almost all the various definitions of attitudes (e.g., J. M. Olson & Zanna, 1993) and their measures (Gawronski & Bodenhausen,

2007). Attitudes are usually assumed to involve/reflect the tendency of the 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). Inconsistent findings emerge between explicit and implicit measures of attitudes. Results from self-reports, generally referred to as "explicit measures," are inconsistent with reaction-time tasks, generally referred to as "implicit measures" (Gawronski & Bodenhausen, 2007; but see Fazio & Olson, 2003). Although self-report measures are usually highly correlated with each other, there is low to zero correlation between self-reports for implicit measures and between different types of implicit measures (Gawronski & Bodenhausen, 2007; Gawronski, Hofmann, & Wilbur, 2006). The lack of consistent, strong correlations between the measures raises the question of 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 appears to be an inconsistent relationship between affective and cognitive/semantic or explicit and implicit measures might possibly reflect a failure to take into account the distinction between semantic and affective representations of valence. Consistent with this view, the majority of the implicit measures are reaction-time tasks that involve cognitive/semantic conflicts and, as suggested in the previous discussion in regard to the affective Simon task, they might reflect semantic knowledge about valence and not affective response. Explicit measures are usually self-reports, often of valence (Eagly & Chaiken, 1993, 1998) that, at least in some cases, reflect more affective than semantic information.

Inconsistent Effects of Repeated Exposure on Self-Reports

Previous studies showed inconsistent effects of repeated exposure to stimuli on self-reports of feelings. For example, in the study by Bradley, Lang, and Cuthbert (1993), 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 attenuate with repeated exposure (Itkes et al., 2017). As discussed before, it is possible that standard self-reports of positive and negative feelings (e.g., valence scale; Lang, Bradley, & Cuthbert, 1998) 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). Similarly, the valence dimension might be more prone than arousal to include semantic components because the valence dimension is sometimes interpreted as being more reflective of the "cognitive" component (Cacioppo, Gardner, & Berntson, 1999). Also, valence can be easily attributed to both the feelings of the observer (I feel bad) and to the stimulus, for example, a picture of chemotherapy treatment (cancer is bad). However, this is not the case with arousal; while the feelings in response to a picture of chemotherapy can be described in terms of arousal, it is less likely that people will describe cancer as "arousing."

Future Challenges

A first future direction for research will be to learn how valence is represented within different knowledge systems. Tulving suggested that in order for a science to grow, special effort should be devoted to clarifying ambiguous concepts (Tulving, 1972). In affective science, the term "valence" is often used as an umbrella term that refers to psychologically different constructs. In the current work, we suggested the distinction between valence of affective response and valence of general semantic knowledge. However, we do not believe that the work of clarifying the concept of valence ends here. For instance, valence can be represented as semantic knowledge (chocolate is positive), episodic knowledge (I felt good yesterday when I ate chocolate), personal attitudes (I like chocolate), or procedural knowledge (I smiled out of politeness when he offered me chocolate). One question that needs further refinement is how valence is represented within various knowledge systems.

A second future challenge is to study the interaction between semantic and affective representations of valence. Until this point, we focused on the dissociation between affective and semantic representations. A future important challenge is to deepen the understanding of the different principles that characterize these two types of representations. Understanding the differences could teach us more about what emotions are and what knowledge is, and the difference between the two. At the same time, and not less challenging, there is the empirical examination of their interactions—whether and how semantic evaluation influences the affective response and vice versa. One example of such a potential interaction discussed before is the case of affective quality and its role in changing core affect (Russell, 2003). A second example is using meaning-making strategies (e.g., affect labeling) or meaning-shifting strategies (e.g., reappraisal) to reduce the impact of emotion-related information (e.g., Lieberman et al., 2007). One potential mechanism by which such effects might be obtained is by shifting from affect-related processing of affective stimuli to a more abstract, symbolic processing (see Lieberman et al., 2007). The distinction between affective and semantic modes of valence might potentially contribute to understanding the mechanisms underlying this shift.

A third future challenge is using the distinction between affective and semantic valence to interpret previous literature. If one accepts that valence can reflect both semantic and affective processing, then the immediate consequence is that for many of the tasks that manipulate valence the question arises of the extent to which a specific task reflects affective or semantic aspects. An important challenge is to parse existing literature to accurately identify the underlying mechanism (i.e., whether it is semantic or affective). One such example discussed in detail in

the previous lines is that of the tasks that involve cognitive conflict resulting from stimulus meaning, such as the extrinsic affective Simon task (De Houwer, 2003), the affective priming task (Hermans et al., 1994; Klauer & Musch, 2003; Otten & Wentura, 1999) and the IAT. Although in the previous discussion we suggested that these types of tasks are likely to be based on semantic valence, more systematic research is needed to determine whether or not this is the case. Another example are the tasks that involve emotion recognition in which participants are asked to label the emotion of other people based on facial or body expressions (e.g., Elfenbein & Ambady, 2002). Although recognition of emotion expression might reflect semantic valence, it is frequently used to infer about the structure of affective valence (e.g., Jack, Garrod, Yu, Caldara, & Schyns, 2012). A third example are self-reports that might be prone to reflect semantic information when experience accessibility is low (Robinson & Clore, 2002a). In fact, it is possible that many of the tasks used to study emotion involve both semantic and affective valence. For instance, during a semantic classification task of affective stimuli in which participants are asked to decide whether an image belongs to either a positive or negative category (semantic valence), participants might also experience an affective response. Thus, the more appropriate question might be not whether a task is semantic or affective, but rather whether the measures that are used and the information that is extracted from the task are semantic or affective.

Finally, in this article we focused on valence and the affective response. Valence was a simple, easy framework to present the distinction between affective and semantic representations. However, the logic of this distinction might be applied to discrete emotions (feeling fear vs. knowing that event X usually elicits fear). Future research should examine the applicability of the affective/semantic distinction in the case of discrete emotions.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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References

Abelson, R. P., & Sermat, V. (1962). Multidimensional scaling of facial expressions. *Journal of Experimental Psychology*, *63*(6), 546–554.

Arkes, H. R., & Tetlock, P. E. (2004). Attributions of implicit prejudice, or "would Jesse Jackson 'fail' the Implicit Association Test?" *Psychological Inquiry*, *15*(4), 257–278.

Averill, J. R. (1975). *A semantic atlas of emotional concepts* (JSAS Catalogue of Selected Documents in Psychology, Ms. No. 421).

Aviezer, H., Hassin, R. R., Ryan, J., Grady, C., Susskind, J., Anderson, A., & Bentin, S. (2008). Angry, disgusted, or afraid? Studies on the malleability of emotion perception. *Psychological Science*, *19*(7), 724–732.

Aviezer, H., Trope, Y., & Todorov, A. (2012). Body cues, not facial expressions, discriminate between intense positive and negative emotions. *Science*, *338*(6111), 1225–1229.

Barrett, L. F. (2006). Valence is a basic building block of emotional life. *Journal of Research in Personality*, *40*(1), 35–55.

Barrett, L. F. (2017). The theory of constructed emotion: An active inference account of interoception and categorization. *Social Cognitive and Affective Neuroscience*, *12*(1), 1–23.

Barrett, L. F., Mesquita, B., Ochsner, K. N., & Gross, J. J. (2007). The experience of emotion. *Annual Review of Psychology*, *58*, 373–403.

Barrett, L., & Russell, J. A. (1998). Independence and bipolarity in the structure of current affect. *Journal of Personality and Social Psychology*, *74*(4), 967–984.

Barsalou, L. W. (1999). Perceptual symbol systems. *Behavioral and Brain Sciences*, *22*(4), 577–660.

Borgatta, E. F. (1961). Mood, personality, and interaction. *The Journal of General Psychology*, *64*(1), 105–137.

Bradley, M. M., Codispoti, M., Cuthbert, B. N., & Lang, P. J. (2001). Emotion and motivation I: Defensive and appetitive reactions in picture processing. *Emotion*, *1*(3), 276–298.

Bradley, M. M., & Lang, P. J. (1994). Measuring emotion: The self-assessment manikin and the semantic differential. *Journal of Behavior Therapy and Experimental Psychiatry*, *25*(1), 49–59.

Bradley, M. M., Lang, P. J., & Cuthbert, B. N. (1993). Emotion, novelty, and the startle reflex: Habituation in humans. *Behavioral Neuroscience*, *107*(6), 970–980.

Bush, L. E. (1973). Individual differences multidimensional scaling of adjectives denoting feelings. *Journal of Personality and Social Psychology*, *25*(1), 50–57.

Cacioppo, J. T., Gardner, W. L., & Berntson, G. G. (1997). Beyond bipolar conceptualizations and measures: The case of attitudes and evaluative space. *Personality and Social Psychology Review*, *1*(1), 3–25.

Cacioppo, J. T., Gardner, W. L., & Berntson, G. G. (1999). The affect system has parallel and integrative processing components: Form follows function. *Journal of Personality and Social Psychology*, *76*(5), 839–855.

Chi, M. T., & Roscoe, R. D. (2002). The processes and challenges of conceptual change. In M. Limon & L. Mason (Eds.), *Reconsidering conceptual change: Issues in theory and practice* (pp. 3–27). Utrecht, The Netherlands: Kluwer Academic.

Cliff, N., & Young, F. W. (1968). On the relation between undimensional judgments and multidimensional scaling. *Organizational Behavior and Human Performance*, *3*(3), 269–285.

Clyde, D. J. (1963). *Manual for the Clyde Mood Scale*. Miami, FL: Biometric Laboratory, University of Miami.

Codispoti, M., Ferrari, V., & Bradley, M. M. (2006). Repetitive picture processing: Autonomic and cortical correlates. *Brain Research*, *1068*(1), 213–220.

Codispoti, M., Ferrari, V., De Cesarei, A., & Cardinale, R. (2006). Implicit and explicit categorization of natural scenes. *Progress in Brain Research*, *156*, 53–65.

Dael, N., Mortillaro, M., & Scherer, K. R. (2012). Emotion expression in body action and posture. *Emotion*, *12*(5), 1085–1101.

Darwin, C. (1873). *Origin of certain instincts. Nature*, *7*, 417–418.

De Houwer, J. (2001). A structural and process analysis of the Implicit Association Test. *Journal of Experimental Social Psychology*, *37*(6), 443–451.

De Houwer, J. (2003). The extrinsic affective Simon task. *Experimental Psychology*, *50*(2), 77–85.

De Houwer, J., Crombez, G., Baeyens, F., & Hermans, D. (2001). On the generality of the affective Simon effect. *Cognition and Emotion*, *15*(2), 189–206.

De Houwer, J., & Eelen, P. (1998). An affective variant of the Simon paradigm. *Cognition and Emotion*, *12*(1), 45–62.

Devine, P. G. (1989). Stereotypes and prejudice: Their automatic and controlled components. *Journal of Personality and Social Psychology*, *56*(1), 5–18.

Dittmann, A. T. (1972). *Interpersonal messages of emotion*. New York, NY: Springer.

Dolan, R. J. (2002). Emotion, cognition, and behavior. *Science*, *298*(5596), 1191–1194.

Duscherer, K., Holender, D., & Molenaar, E. (2008). Revisiting the affective Simon effect. *Cognition and Emotion*, *22*(2), 193–217.

Eagly, A. H., & Chaiken, S. (1993). *The psychology of attitudes*. Fort Worth, TX: Harcourt Brace Jovanovich.

Eagly, A. H., & Chaiken, S. (1998). Attitude structure and function. In D. T. Gilbert, S. T. Fiske & G. Lindzey (Eds.), *The handbook of social psychology* (4th ed., *Vol. 1*, pp. 269–322). New York, NY: McGraw-Hill.

Ebner, N. C., Riediger, M., & Lindenberger, U. (2010). FACES—A database of facial expressions in young, middle-aged, and older women and men: Development and validation. *Behavior Research Methods*, *42*(1), 351–362.

Ekman, P. (1992). An argument for basic emotions. *Cognition and Emotion*, *6*(3–4), 169–200.

Ekman, P., & Friesen, W. V. (1976). Measuring facial movement. *Environmental Psychology and Nonverbal Behavior*, *1*(1), 56–75.

Elfenbein, H. A., & Ambady, N. (2002). On the universality and cultural specificity of emotion recognition: A meta-analysis. *Psychological Bulletin*, *128*(2), 203–265.

Engen, T., Levy, N., & Schlosberg, H. (1957). A new series of facial expressions. *American Psychologist*, *12*(5), 264–266.

Engen, T., Levy, N., & Schlosberg, H. (1958). The dimensional analysis of a new series of facial expressions. *Journal of Experimental Psychology*, *55*(5), 454–458.

Fazio, R. H., & Olson, M. A. (2003). Implicit measures in social cognition research: Their meaning and use. *Annual Review of Psychology*, *54*(1), 297–327.

Fernández-Dols, J. M., & Crivelli, C. (2013). Emotion and expression: Naturalistic studies. *Emotion Review*, *5*, 24–29.

Folkman, S., Lazarus, R. S., Dunkel-Schetter, C., DeLongis, A., & Gruen, R. J. (1986). Dynamics of a stressful encounter: Cognitive appraisal, coping, and encounter outcomes. *Journal of Personality and Social Psychology*, *50*(5), 992–1003.

Furnham, A. (1986). Response bias, social desirability and dissimulation. *Personality and Individual Differences*, *7*(3), 385–400.

Gawronski, B., & Bodenhausen, G. V. (2007). Unraveling the processes underlying evaluation: Attitudes from the perspective of the APE model. *Social Cognition*, *25*(5), 687–717.

Gawronski, B., Hofmann, W., & Wilbur, C. J. (2006). Are "implicit" attitudes unconscious? *Consciousness and Cognition*, *15*(3), 485–499.

Glenberg, A. M. (1997). What memory is for. *Behavioral and Brain Sciences*, *20*(1), 1–19.

Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. K. (1998). Measuring individual differences in implicit cognition: The Implicit Association Test. *Journal of Personality and Social Psychology*, *74*(6), 1464–1480.

Greenwald, A. G., Nosek, B. A., & Banaji, M. R. (2003). Understanding and using the Implicit Association Test: I. An improved scoring algorithm. Journal of Personality and Social Psychology, *85*(2), 197–216.

Hamzani, O., Mazar, T., Itkes, O., Petranker, R., & Kron, A. (2019). Semantic and affective representations of valence: Prediction of autonomic and facial responses from feelings-focused and knowledge-focused self-reports. *Emotion*. Advance online publication. doi:10.1037/emo0000567

Henry, J. P. (1986). Neuroendocrine patterns of emotional response. In R. Plutchik & H. Kellerman (Eds.), *Emotion: Theory, research, and experience. Vol. 3: Biological foundations of emotion* (pp. 37–60). Orlando, FL: Academic Press.

Hermans, D., De Houwer, J., & Eelen, P. (1994). The affective priming effect: Automatic activation of evaluative information in memory. *Cognition and Emotion*, *8*(6), 515–533.

Hommel, B. (1993). Inverting the Simon effect by intention. *Psychological Research*, *55*(4), 270–279.

Huijding, J., & de Jong, P. J. (2005). A pictorial version of the extrinsic affective Simon task: Sensitivity to generally affective and phobia-relevant stimuli in high and low spider fearful individuals. *Experimental Psychology*, *52*(4), 289–295.

Itkes, O., Eviatar, Z., & Kron, A. (2019). Semantic and affective manifestations of ambi (valence). *Cognition and Emotion*, *33*(7), 1356–1369.

Itkes, O., Kimchi, R., Haj-Ali, H., Shapiro, A., & Kron, A. (2017). Dissociating affective and semantic valence. *Journal of Experimental Psychology: General*, *146*(7), 924–942.

Izard, C. E., Bartlett, E. S., & Marshall, A. G. (1972). *Patterns of emotions*. New York, NY: Academic Press.

Jack, R. E., Garrod, O. G., Yu, H., Caldara, R., & Schyns, P. G. (2012). Facial expressions of emotion are not culturally universal. *Proceedings of the National Academy of Sciences*, *109*(19), 7241–7244.

Karmon-Presser, A., Sheppes, G., & Meiran, N. (2018). How does it "feel"? A signal detection approach to feeling generation. *Emotion*, *18*(1), 94–115.

Karpinski, A., & Hilton, J. L. (2001). Attitudes and the Implicit Association Test. *Journal of Personality and Social Psychology*, *81*(5), 774–788.

Khan, R. M., Luk, C. H., Flinker, A., Aggarwal, A., Lapid, H., Haddad, R., & Sobel, N. (2007). Predicting odor pleasantness from odorant structure: Pleasantness as a reflection of the physical world. *Journal of Neuroscience*, *27*(37), 10015–10023.

Klauer, K. C., & Musch, J. (2003). Affective priming: Findings and theories. In J. Musch & K. C. Klauer (Eds.), *The psychology of evaluation: Affective processes in cognition and emotion* (pp. 7–49). Mahwah, NJ: Lawrence Erlbaum Associates.

Kornblum, S., Hasbroucq, T., & Osman, A. (1990). Dimensional overlap: Cognitive basis for stimulus–response compatibility—a model and taxonomy. *Psychological Review*, *97*(2), 253–270.

Kron, A., Goldstein, A., Lee, D. H. J., Gardhouse, K., & Anderson, A. K. (2013). How are you feeling? Revisiting the quantification of emotional qualia. *Psychological Science*, *24*(8), 1503–1511.

Kron, A., Pilkiw, M., Banaei, J., Goldstein, A., & Anderson, A. K. (2015). Are valence and arousal separable in emotional experience? *Emotion*, *15*(1), 35–44.

Kross, E., & Ayduk, O. (2011). Making meaning out of negative experiences by self-distancing. *Current Directions in Psychological Science*, *20*(3), 187–191.

Lai, V. T., Hagoort, P., & Casasanto, D. (2012). Affective primacy vs. cognitive primacy: Dissolving the debate. *Frontiers in Psychology*, *3*. doi:10.3389/fpsyg.2012.00243

Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (1998). *International Affective Picture System (IAPS): Technical manual and affective ratings*. Gainesville, FL: The Center for Research in Psychophysiology, University of Florida.

Lang, P. J., Greenwald, M. K., Bradley, M. M., & Hamm, A. O. (1993). Looking at pictures: Affective, facial, visceral, and behavioral reactions. *Psychophysiology*, *30*(3), 261–273.

Larsen, J. T., & McGraw, A. P. (2011). Further evidence for mixed emotions. *Journal of Personality and Social Psychology*, *100*(6), 1095–1110.

Larsen, J. T., McGraw, A. P., & Cacioppo, J. T. (2001). Can people feel happy and sad at the same time? *Journal of Personality and Social Psychology*, *81*(4), 684–696.

Larsen, J. T., Norris, C. J., & Cacioppo, J. T. (2003). Effects of positive and negative affect on electromyographic activity over zygomaticus major and corrugator supercilii. *Psychophysiology*, *40*(5), 776–785.

Lazarus, R. S., & Smith, C. A. (1988). Knowledge and appraisal in the cognition–emotion relationship. *Cognition and Emotion*, *2*(4), 281–300.

Levenson, R. W. (2003). Blood, sweat, and fears: The autonomic architecture of emotion. *Annals of the New York Academy of Sciences*, *1000*(1), 348–366.

Lieberman, M. D., Eisenberger, N. I., Crockett, M. J., Tom, S. M., Pfeifer, J. H., & Way, B. M. (2007). Putting feelings into words. *Psychological Science*, *18*(5), 421–428.

Lu, C. H., & Proctor, R. W. (1995). The influence of irrelevant location information on performance: A review of the Simon and spatial Stroop effects. *Psychonomic Bulletin & Review*, *2*(2), 174–207.

Lu, C. H., & Proctor, R. W. (2001). Influence of irrelevant information on human performance: Effects of SR association strength and relative timing. *The Quarterly Journal of Experimental Psychology Section A*, *54*(1), 95–136.

Majid, A., Burenhult, N., Stensmyr, M., de Valk, J., & Hansson, B. S. (2018). Olfactory language and abstraction across cultures. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *373*(1752). doi:10.1098/rstb.2017.0139

Markman, A. B. (2013). *Knowledge representation*. Abingdon, UK: Psychology Press.

Mehrabian, A. (1972). *Nonverbal communication*. New Brunswick, NJ: Transaction.

Mehrabian, A., & Ksionzky, S. (1974). *A theory of affiliation*. Lexington, MA: D. C. Heath.

Metcalfe, J., & Mischel, W. (1999). A hot/cool-system analysis of delay of gratification: Dynamics of willpower. *Psychological Review*, *106*(1), 3–19.

Mierke, J., & Klauer, K. C. (2003). Method-specific variance in the Implicit Association Test. *Journal of Personality and Social Psychology*, *85*(6), 1180–1192.

Nelson, K. (1973). Some evidence for the cognitive primacy of categorization and its functional basis. *Merrill-Palmer Quarterly of Behavior and Development*, *19*(1), 21–39.

Niedenthal, P. M., Barsalou, L. W., Winkielman, P., Krauth-Gruber, S., & Ric, F. (2005). Embodiment in attitudes, social perception, and emotion. *Personality and Social Psychology Review*, *9*(3), 184–211.

Niedenthal, P. M., Winkielman, P., Mondillon, L., & Vermeulen, N. (2009). Embodiment of emotion concepts. *Journal of Personality and Social Psychology*, *96*(6), 1120–1136.

Nosek, B. A., Greenwald, A. G., & Banaji, M. R. (2005). Understanding and using the Implicit Association Test: II. Method variables and construct validity. *Personality and Social Psychology Bulletin*, *31*(2), 166–180.

Nowlis, V. (1965). Research with the Mood Adjective Checklist. In S. S. Tomkin & C. E. Izard (Eds.), *Affect, cognition, and personality* (pp. 352–389). New York, NY: Springer.

Nummenmaa, L., Hyönä, J., & Calvo, M. G. (2010). Semantic categorization precedes affective evaluation of visual scenes. *Journal of Experimental Psychology: General*, *139*(2), 222–246.

Olofsson, J. K., Bowman, N. E., & Gottfried, J. A. (2013). High and low roads to odor valence? A choice response-time study. *Journal of Experimental Psychology: Human Perception and Performance*, *39*(5), 1205–1211.

Olofsson, J. K., Bowman, N. E., Khatibi, K., & Gottfried, J. A. (2012). A time-based account of the perception of odor objects and valences. *Psychological Science*, *23*(10), 1224–1232.

Olson, J. M., & Zanna, M. P. (1993). Attitudes and attitude change. *Annual Review of Psychology*, *44*(1), 117–154.

Olson, M. A., & Fazio, R. H. (2004). Reducing the influence of extrapersonal associations on the Implicit Association Test: Personalizing the IAT. *Journal of Personality and Social Psychology*, *86*(5), 653–667.

Osgood, C. E. (1962). Studies on the generality of affective meaning systems. *American Psychologist*, *17*(1), 10–28.

Osgood, C. E., May, W. H., & Miron, M. S. (1975). *Cross-cultural universals of affective meaning* (Vol. 1). Urbana: University of Illinois Press.

Otten, S., & Wentura, D. (1999). About the impact of automaticity in the minimal group paradigm: Evidence from affective priming tasks. *European Journal of Social Psychology*, *29*(8), 1049–1071.

Patterson, K., Nestor, P. J., & Rogers, T. T. (2007). Where do you know what you know? The representation of semantic knowledge in the human brain. *Nature Reviews Neuroscience*, *8*(12), 976–987.

Reisenzein, R., Studtmann, M., & Horstmann, G. (2013). Coherence between emotion and facial expression: Evidence from laboratory experiments. *Emotion Review*, *5*, 16–23.

Robinson, M. D., & Clore, G. L. (2002a). Belief and feeling: Evidence for an accessibility model of emotional self-report. *Psychological Bulletin*, *128*(6), 934–960.

Robinson, M. D., & Clore, G. L. (2002b). Episodic and semantic knowledge in emotional self-report: Evidence for two judgment processes. *Journal of Personality and Social Psychology*, *83*(1), 198–215.

Rosch, E., Mervis, C. B., Gray, W. D., Johnson, D. M., & Boyes-Braem, P. (1976). Basic objects in natural categories. *Cognitive Psychology*, *8*(3), 382–439.

Roseman, I. J., & Smith, C. A. (2001). Appraisal theory: Overview, assumptions, varieties, controversies. In K. R. Scherer, A. Schorr & T. Johnstone (Eds.), *Appraisal processes in emotion: Theory, methods, research* (pp. 3–19). New York, NY: Oxford University Press.

Royal, D. C., & Hays, W. L. (1959). Empirical dimensions of emotional behavior. *Acta Psychologica*, *15*, 1152–1168.

Russell, J. A. (1980). A circumplex model of affect. *Journal of Personality and Social Psychology*, *39*(6), 1161–1178.

Russell, J. A. (2003). Core affect and the psychological construction of emotion. *Psychological Review*, *110*(1), 145–172.

Russell, J. A. (2005). Emotion in human consciousness is built on core affect. *Journal of Consciousness Studies, 12*(8–9), 26–42.

Russell, J. A., & Barrett, L. F. (1999). Core affect, prototypical emotional episodes, and other things called emotion: Dissecting the elephant. *Journal of Personality and Social Psychology*, *76*(5), 805–819.

Russell, J. A., & Mehrabian, A. (1974). Distinguishing anger and anxiety in terms of emotional response factors. *Journal of Consulting and Clinical Psychology*, *42*(1), 79–83.

Russell, J. A., & Mehrabian, A. (1977). Evidence for a three-factor theory of emotions. *Journal of Research in Personality*, *11*(3), 273–294.

Schacter, D. L., Wagner, A. D., & Buckner, R. L. (2000). Memory systems of 1999. In E. Tulving & F. I. M. Craik (Eds.), *Oxford handbook of memory* (pp. 627–643). New York, NY: Oxford University Press.

Schaefer, A., Collette, F., Philippot, P., van der Linden, M., Laureys, S., Delfiore, G., . . . Salmon, E. (2003). Neural correlates of "hot" and "cold" emotional processing: A multilevel approach to the functional anatomy of emotion. *NeuroImage*, *18*(4), 938–949.

Schlosberg, H. (1954). Three dimensions of emotion. *Psychological Review*, *61*(2), 81–88.

Schwarz, N. (2007). Attitude construction: Evaluation in context. *Social Cognition*, *25*(5), 638–656.

Schwarz, N. (2012). Feelings-as-information theory. In P. A. M. van Lange, A. Kruglanski & E. T. Higgins (Eds.), *Handbook of theories of social psychology* (pp. 289–308). Thousand Oaks, CA: SAGE.

Schwarz, N., & Bohner, G. (2001). The construction of attitudes. In A. Tesser & N. Schwarz (Eds.), *Blackwell handbook of social psychology: Intraindividual processes* (pp. 436–457). Malden, MA: Blackwell.

Schupp, H. T., Stockburger, J., Codispoti, M., Junghoefer, M., Weike, A. I., & Hamm, A. O. (2006). Stimulus novelty and emotion perception: The near absence of habituation in the visual cortex. *Neuroreport, 17,* 365–369.

Shepard, R. N. (1962). The analysis of proximities: Multidimensional scaling with an unknown distance function. I. *Psychometrika*, *27*(2), 125–140.

Snider, J. G., & Osgood, C. E. (Eds.). (1969). *Semantic differential technique: A sourcebook*. Chicago, IL: Aldine.

Spruyt, A., De Houwer, J., Hermans, D., & Eelen, P. (2007). Affective priming of nonaffective semantic categorization responses. *Experimental Psychology*, *54*(1), 44–53.

Storbeck, J., Robinson, M. D., & McCourt, M. E. (2006). Semantic processing precedes affect retrieval: The neurological case for cognitive primacy in visual processing. *Review of General Psychology*, *10*(1), 41–55.

Strack, F., & Deutsch, R. (2004). Reflective and impulsive determinants of social behavior. *Personality and Social Psychology Review*, *8*(3), 220–247.

Tottenham, N., Tanaka, J. W., Leon, A. C., McCarry, T., Nurse, M., Hare, T. A., . . . Nelson, C. (2009). The NimStim set of facial expressions: Judgments from untrained research participants. *Psychiatry Research*, *168*(3), 242–249.

Tulving, E. (1972). Episodic and semantic memory. *Organization of Memory*, *1*, 381–403.

Tulving, E. (1984). Précis of elements of episodic memory. *Behavioral and Brain Sciences*, *7*(2), 223–238.

Tulving, E. (1993). What is episodic memory? *Current Directions in Psychological Science*, *2*(3), 67–70.

Van de Mortel, T. F. (2008). Faking it: Social desirability response bias in self-report research. *The Australian Journal of Advanced Nursing*, *25*(4), 40–48.

Wheeler, M. A., Stuss, D. T., & Tulving, E. (1997). Toward a theory of episodic memory: The frontal lobes and autonoetic consciousness. *Psychological Bulletin*, *121*(3), 331–354.

Wilson, T. D., Lindsey, S., & Schooler, T. Y. (2000). A model of dual attitudes. *Psychological Review*, *107*(1), 101–126.

Winkielman, P., Coulson, S., & Niedenthal, P. (2018). Dynamic grounding of emotion concepts. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *373*(1752). doi:10.1098/rstb.2017.0127

Yik, M. S., Russell, J. A., & Barrett, L. F. (1999). Structure of self-reported current affect: Integration and beyond. *Journal of Personality and Social Psychology*, *77*(3), 600–619.

Zajonc, R. B. (1980). Feeling and thinking: Preferences need no inferences. *American Psychologist*, *35*(2), 151–175.