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THE ASSOCIATIVE-PROPOSITIONAL DUALITY IN THE REPRESENTATION, FORMATION, AND EXPRESSION OF ATTITUDES

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One of the most significant developments in the history of social psychology has been the emergence of dual-process theories (for reviews, see Gawronski & Creighton, 2013; Sherman, Gawronski, & Trope, 2014). The central assumption underlying these theories is that judgments and behavior are the product of two qualitatively distinct mental processes, one of which operates in an automatic fashion, while the other operates in a controlled fashion. This idea also had a major impact on attitude research, which has been guided by dual-process theories since their first appearance in the field. For example, the MODE model provided valuable insights into two distinct pathways by which attitudes guide behavior (Fazio, 1990); the elaboration-likelihood model (ELM) integrated a wide range of disparate findings by distinguishing between central and peripheral routes to attitude change (Petty & Cacioppo, 1986); and the heuristic-systematic model (HSM) illuminated the interplay of heuristic and systematic processes underlying the effects of persuasive messages (Chaiken, Liberman, & Eagly, 1989).

Integrating these and various other dual-process theories within a single unifying framework, Smith and DeCoster (2000) argued that the proposed dualities can be understood in terms of two mental systems with distinct functional properties. One system, described as *associative*, is assumed to capture observed regularities through the slow, incremental formation of associations on the basis of feature similarity and spatio-temporal contiguity. The other system, described as *rule-based*, draws on symbolically represented rules that can be learned rapidly on the basis of very few experiences. Smith and DeCoster's integration of various

domain-specific dual-process theories provided the basis for the development of generalized dual-process theories that aim to identify basic principles of information processing and their implications for human behavior.

One of the most influential examples of such generalized dual-process theories is Strack and Deutsch's (2004) Reflective–Impulsive Model (RIM). According to the RIM, human behavior is guided by two interacting systems that are characterized by distinct principles of information processing and behavior determination. The *reflective system* is assumed to influence behavior through reasoned decisions that are based on beliefs about facts and values. In contrast, the *impulsive system* is assumed to elicit spontaneous tendencies of approach and avoidance through the spread of activation within associative networks. Although the RIM shares many assumptions with Smith and DeCoster's (2000) framework, the two theories differ in their emphasis of central characteristics of the proposed systems. Whereas Smith and DeCoster's theory expands on connectionist models of learning and memory that distinguish between the incremental formation of associations and the rapid learning of inferential rules (McClelland, McNaughton, & O'Reilly, 1995), Strack and Deutsch's theory emphasizes the interactive roles of associative and propositional processes in the determination of human behavior. Since the publication of Strack and Deutsch's seminal article, the associative-propositional duality has had a major impact on attitude research, including our own work under the umbrella of the associative-propositional evaluation (APE) model (Gawronski & Bodenhausen, 2006, 2011).

Although attitude research guided by the associative-propositional duality has led to many invaluable insights, it has also been the target of criticism. The most prominent critique is that the observed phenomena can be explained by single-process propositional accounts without invoking any reference to the notion of associative processing (e.g., de Houwer, 2009, 2014; Kruglanski & Gigerenzer, 2011; Kruglanski & Thompson, 1999; Mitchell, de Houwer, & Lovibond, 2009). In the current chapter, we address this criticism with an emphasis on the different meanings of the associative-propositional duality in the attitudes literature. Our main argument is that the associative-propositional duality has been used interchangeably to refer to three different aspects of attitudes: (1) the nature of stored evaluative representations in long-term memory, (2) the processes by which evaluative representations are formed, and (3) the processes involved in the behavioral expression of stored evaluative representations. Drawing on a conceptual analysis of the three aspects, we argue that some disagreements between dual-process and single-process theorists involve genuine empirical issues, whereas others are the product of differing terminology and mischaracterizations of the dual-process view. On the basis of our analysis, we conclude that the associative-propositional distinction is (1) theoretically implausible for the nature of evaluative representations, (2) empirically supported for the formation of evaluative representations, and (3) conceptually warranted for the behavioral expression of evaluative representations.

Nature of Evaluative Representations

In the context of evaluative representations, the associative-propositional duality has sometimes been used to refer to *associations* and *propositions* as distinct knowledge structures in long-term memory. Theoretically, associations are mental links between nodes that may differ in terms of their relative strength; propositions are mentally represented statements about states of affairs that may be deemed accurate or inaccurate. According to this conceptualization, associations and propositions differ in two fundamental ways (de Houwer, 2009). First, whereas propositions have a subjective truth value in the sense that they may be deemed accurate or inaccurate, associations are neither true nor false. Second, it has been argued that propositions go beyond mere associations by specifying the manner in which concepts are related (e.g., A is a *cause* of B vs. A is an *effect* of B). We argue that either of these characteristics provides a weak basis for duality claims at the level of stored knowledge structures in long-term memory.

Although some theorists assume that people can have two distinct attitudes toward the same object stored in memory (e.g., Greenwald & Banaji, 1995; Wilson, Lindsey, & Schooler, 2000), we argue that a duality account based on the distinction between associations and propositions as two independent memory structures is theoretically implausible. Such an account would imply that propositional statements about states of affairs are stored in a manner that does not involve any kind of associative links. Counter to this idea, most theories that are based on the associative-propositional duality do *not* assume two distinct memory stores for associations and propositions (e.g., Strack & Deutsch, 2004). Instead, these theories propose a single associative store that provides the basis for propositions about states of affairs in the form of patterns of momentarily activated associations. According to this view, the distinction between associations and propositions does not describe two distinct *types* of stored knowledge structures in long-term memory, but different *states* of stored knowledge. Associations can be understood as dormant links between nodes that constrain the spread of activation within associative networks. Activated patterns of associations, in turn, are assumed to provide the basis for momentarily constructed propositions about states of affairs. From this perspective, any proposition is based on patterns of activated associations; there is no association-independent storage of propositional statements in a different part of long-term memory.

A second feature that is often used to distinguish between associations and propositions is that propositions describe *how* two (or more) concepts are related. This capacity is claimed to be absent in associations, which capture the mere fact *that* two (or more) concepts are related (de Houwer, 2009). According to this view, a simple associative link between A and B does not provide any information on whether A causes or prevents B, or whether A likes or dislikes B. This argument is particularly important for attitude research, because the nature of the relation between objects and events can have different implications for the evaluation of

an attitude object. For example, an object that prevents positive outcomes is likely perceived negatively despite the association with something good, and being disliked by a dislikeable person may be perceived as something good despite the association with something bad (Heider, 1958). There is no doubt that humans have the capacity to understand these differences, which has led proponents of propositional accounts to reject the idea of associations as a basis for stored knowledge (e.g., de Houwer, 2009; Mandelbaum, in press).

We argue that this rejection is based on a very narrow interpretation of associative representations that reduces them to primitive links between two concept nodes. After all, multi-layer connectionist models involving both excitatory and inhibitory links are perfectly able to represent complex relations between objects and events (e.g., McClelland et al., 1995). Such models often include a hierarchical structure, in that activated concepts at higher levels specify the relation between activated concepts at lower levels. Mental representations of this kind could be described as *propositional*, because they capture relational information. Alternatively, they could be described as *associative*, because they are based on associative links between nodes. From this perspective, the preferred label becomes a matter of terminological taste rather than genuine theoretical disagreement. In our view, the central question is not whether associative networks are capable of representing complex relations between stimuli. Rather, the more important question is whether observed co-occurrences of stimuli in the environment can create unqualified links between the co-occurring stimuli irrespective of their relation (e.g., an unqualified associative link between A and B, when A prevents B).[1] This question does not pertain to the status of associations and propositions as distinct knowledge structures in long-term memory, but to the role of associative and propositional processes in the formation of evaluative representations.

Formation of Evaluative Representations

In the context of attitude formation and change, the associative-propositional duality has been used to describe two functionally distinct mechanisms by which mental representations are formed (Gawronski & Bodenhausen, 2006, 2011). The first mechanism, often described as *associative learning*, involves the formation of mental links on the basis of observed spatio-temporal contiguities between objects and events. Resonating with the Hebbian principle of *fire together, wire together*, this learning mechanism is assumed to capture regularities in the environment by creating direct mental links between simultaneously activated concepts: "The general idea is an old one, that any two cells or systems of cells that are repeatedly active at the same time will tend to become associated, so that activity in one facilitates activity in the other" (Hebb, 1949, p. 70). The second mechanism, often described as *propositional learning*, involves the formation of mental representations on the basis of newly acquired information about states of affairs.

Similar to the distinction between associations and propositions as mental structures, the two learning mechanisms differ in two fundamental ways. First, whereas associative learning is based on observed regularities regardless of their perceived validity, propositional learning depends on the perceived validity of newly acquired information. Second, whereas the representational products of propositional learning capture the relation between two co-occurring stimuli, the representational products of associative learning reflect the mere co-occurrence of stimuli regardless of their (presumed or actual) relation.

Proponents of single-process propositional theories have questioned the existence of associative learning, claiming that all learning in humans is the result of propositional processes (e.g., de Houwer, 2009; Mitchell et al., 2009). Based on a conceptualization of associative and propositional learning in terms of perceived validity and relational information, two central questions in this debate are: (1) Is there evidence for effects of environmental regularities when the observed regularities are deemed invalid? (2) Is there evidence for effects of mere co-occurrences regardless of the relation of the co-occurring stimuli? Although direct investigations of these issues suggest a negative answer to the first question, there is strong evidence for an affirmative answer to the second question.

In response to the challenge of single-process propositional theories, Peters and Gawronski (2011a) conducted a series of studies that investigated the interactive effects of observed contingencies and their perceived validity on spontaneous and deliberate evaluations. Using a simple impression formation task, participants were presented with evaluative statements about four target individuals. For two of the four targets, 75 percent of the statements were positive and 25 percent were negative. For the other two targets, 75 percent of the statements were negative and 25 percent were positive. Participants' task was to guess whether each statement was correct or incorrect. Orthogonal to the manipulation of valence proportions, participants received feedback on their individual guesses, such that for two of the targets the majority information was always correct and the minority information was always incorrect; for the remaining two targets the feedback suggested that the minority information was correct and the majority information was incorrect. Afterwards, spontaneous evaluations were measured with two variants of affective priming (Fazio, Jackson, Dunton, & Williams, 1995; Payne, Cheng, Govorun, & Stewart, 2005); deliberate evaluations were assessed with a self-report measure.

Drawing on the assumption that spontaneous evaluations are more sensitive to the effects of associative learning whereas deliberate evaluations are more sensitive to the effects of propositional learning (Gawronski & Bodenhausen, 2006), Peters and Gawronski expected that spontaneous evaluations would show an unqualified main effect of the observed valence contingencies, such that participants' evaluations would reflect the relative proportion of positive and negative statements irrespective of their validity. In contrast, deliberate evaluations were expected to show an interaction of valence proportions and validity feedback,

reflecting the actual validity of the observed statements rather than the mere proportions of positive and negative statements. Counter to these predictions, both spontaneous and deliberate evaluations showed a significant interaction, indicating that validity information fully qualified the effects of the observed contingencies. These results pose a challenge to dual-process theories of learning, which assume that observed regularities can influence evaluative representations through associative learning even when these regularities are deemed invalid.

At first glance, Peters and Gawronski's findings may seem inconsistent with earlier findings showing that negation (or invalidation) is often ineffective in qualifying the effects of positive and negative information on spontaneous evaluations (e.g., Deutsch, Gawronski, & Strack, 2006; Gawronski, Deutsch, Mbirkou, Seibt, & Strack, 2008). Yet, an important difference between the two lines of research is that Peters and Gawronski investigated the impact of negation during the formation of evaluative representations, whereas earlier research focused on negation effects during the expression of existing representations. In fact, when Peters and Gawronski included a delay between the encoding of evaluative information and its invalidation, they replicated the typical dissociation between spontaneous and deliberate evaluations, showing that spontaneous evaluations were less sensitive to negation than deliberate evaluations. Together, these findings suggest that negation-related dissociations between spontaneous and deliberate evaluations are due to processes operating during the *expression* rather than the *formation* of evaluative representations.

Although Peters and Gawronski's findings suggest a rejection of the associative-propositional duality with regard to the impact of subjective validity during learning, there is evidence that observed co-occurrences can influence evaluative representations regardless of the relation between co-occurring stimuli. This evidence comes from research on evaluative conditioning (EC), showing that repeated pairings of a neutral conditioned stimulus (CS) with a positive or negative unconditioned stimulus (US) can lead to valence-congruent changes in the evaluation of the CS that are unqualified by the particular relation between the two stimuli (e.g., Gawronski, Walther, & Blank, 2005; Hu, Gawronski, & Balas, 2015; Langer, Walther, Gawronski, & Blank, 2009; Moran & Bar-Anan, 2013).

The most compelling evidence for the simultaneous operation of associative and propositional learning has been presented by Moran and Bar-Anan (2013). In their study, participants were presented with neutral stimuli (CS) that started or stopped either pleasant or unpleasant sounds (US). Afterwards, the authors measured spontaneous evaluations of the CSs with an Implicit Association Test (Greenwald, McGhee, & Schwartz, 1998); deliberate evaluations were assessed with a self-report measure. On the measure of deliberate evaluations, participants showed more favorable judgments of stimuli that started pleasant sounds compared with stimuli that started unpleasant sounds. Conversely, participants showed more favorable judgments of stimuli that stopped unpleasant sounds compared with stimuli that stopped pleasant sounds. In contrast, the measure of spontaneous evaluations reflected the mere co-occurrence of CSs and USs regardless of their relation. That is, participants showed more favorable responses to stimuli that co-occurred with pleasant sounds compared with stimuli that co-occurred with unpleasant sounds, regardless of whether the stimuli started or stopped the sounds.

Hu et al. (2015) recently replicated this pattern using an affective priming task (Fazio et al., 1995) and a manipulation of relational information that may be regarded as more ecologically valid. In this study, participants were presented with image pairs involving pharmaceutical products and positive or negative health conditions. Participants were told that the pharmaceutical products either cause or prevent the depicted health conditions. This manipulation was based on the idea that pharmaceutical products can have positive effects (e.g., curing eczema; causing healthy skin) as well as negative side-effects (e.g., causing eczema; impairing healthy skin). Consistent with Moran and Bar-Anan's (2013) results, Hu et al. found that deliberate evaluations of the pharmaceutical products reflected the relation between the product and the depicted health condition. Specifically, participants showed more favorable judgments of products that caused positive health conditions compared with products that caused negative health conditions. Conversely, participants showed more favorable judgments of products that prevented negative health conditions compared with products that prevented positive health conditions. In contrast, spontaneous evaluations of the products remained unqualified by relational information. That is, participants showed more favorable responses to products that were paired with positive health conditions than products that were paired with negative health conditions, regardless of whether the products caused or prevented the health conditions.

Together, these findings support the assumption that observed co-occurrences can shape evaluative representations regardless of the relation between the co-occurring stimuli. Although propositional processes seem to fully override associative effects when the observed regularities are deemed invalid (Peters & Gawronski, 2011a), there is compelling evidence for associative-learning effects that remain unqualified by the relation between co-occurring stimuli (Hu et al., 2015; Moran & Bar-Anan, 2013).[2] Thus, the central question is not *whether* observed co-occurrences between stimuli can influence evaluative representations irrespective of their relation; the question is *when* such influences occur. Although it might be possible to reconcile the obtained effects with single-process propositional theories in a post-hoc fashion (e.g., de Houwer, 2009), dual-process accounts seem superior because they predict these effects a priori instead of explaining them a posteriori on the basis of ad hoc assumptions that do not provide any novel predictions (see Gawronski & Bodenhausen, 2015).

Expression of Evaluative Representations

A third interpretation of the associative-propositional duality in the attitude literature refers to the processes underlying the behavioral expression of evaluative representations. In this context, associative processes pertain to the *activation* of evaluative representations, whereas propositional processes involve the *validation* of activated representations (Gawronski & Bodenhausen, 2006). The central idea underlying this distinction is that the reflective use of stored evaluative information for judgments and decisions depends on two critical factors. First, the relevant information has to be momentarily accessible; that is, dormant knowledge structures have to be activated. Second, the activated information has to be regarded as a suitable basis for judgments and decisions; that is, it has to be regarded as valid. A central assumption of the RIM is that activated information can influence behavior through spontaneous approach-avoidance tendencies even when this information is rejected as a valid basis for reasoned behavioral decisions (Strack & Deutsch, 2004). A common way to study such behavioral conflicts is to assess the behavioral effects of activated information with implicit measures and the behavioral effects of validated information with explicit measures (Gawronski & de Houwer, 2014). These standardized measurements may then be used to predict different kinds of behavior (e.g., spontaneous vs. deliberate behavior; see Dovidio, Kawakami, & Gaertner, 2002, for an example), the same behavior under different conditions (e.g., high vs. low cognitive resources; see Hofmann, Rauch, & Gawronski, 2007, for an example), and behavior of people with different personality characteristics (e.g., preference for intuitive vs. deliberative thinking styles; see Richetin, Perugini, Adjali, & Hurling, 2007, for an example).

Although activation is typically described as an associative process and validation as a propositional process, it is important to note that each process involves several components. From an associative view, the activation of evaluative information is driven by (1) a process of feature matching in the activation of mental concepts that represent a given target object and (2) the spread of activation to other concepts that are mentally linked to the activated target concept. An important aspect of feature matching is that stimuli do not have to be perceptually identical across time and contexts to activate the same representations. Instead, configurations of input stimuli that pass a critical threshold of similarity are sufficient to activate the same mental contents. Thus, even unknown stimuli may elicit spontaneous evaluative responses to the extent that they resemble a previously encountered stimulus with a stored evaluative representation (e.g., Duckworth, Bargh, Garcia, & Chaiken, 2002; Gawronski & Quinn 2013).

An important aspect of spreading activation is that it is not an all-or-none process, such that encountering a given object would activate each and every concept that is mentally linked with that object in memory. Instead, activation typically spreads only to a limited subset of associated concepts. Which subset is activated in response to an object is assumed to be constrained by the overall configuration of input stimuli, including both the target object and the context in which it is encountered. For example, encountering an African American man in a jazz bar may activate the stereotypical attribute *musical*, whereas the same African American man may activate the stereotypical attribute *criminal* if he is encountered in a dark alley (for a review, see Gawronski & Sritharan, 2010).

Such contextual constraints on the spread of activation are not limited to environmental cues with a clear semantic relation to the mental concepts that are associated with a stimulus (e.g., semantic relation between *jazz bar* and the stereotypical attribute *musical*); they may also involve incidental cues that simply happened to be present during the formation of evaluative associations (e.g., perceptual features of a room). Consistent with this assumption, Gawronski, Rydell, Vervliet, and de Houwer (2010) have shown that expectancy-violating counterattitudinal experiences enhance attention to incidental features of the environmental context, thereby leading to an integration of visual context cues into the mental representation of the counterattitudinal experience. As a result, subsequent activation of the counterattitudinal experience is limited to the context in which this experience occurred, whereas initial attitudinal experiences are activated in any other context (for a review, see Gawronski & Cesario, 2013).

A similar differentiation of sub-components is warranted for the notion of propositional validation. Within the APE model, we argued that subjective validity depends on the consistency between the different pieces of activated information (Gawronski & Bodenhausen, 2006; see also Gawronski & Strack, 2004). The basic idea underlying this hypothesis is that inconsistency serves as an epistemic cue for errors in one's system of beliefs (Gawronski, 2012; Quine & Ullian, 1978). Although consistency of activated information is insufficient to establish the accuracy of that information, inconsistency is an unambiguous cue for an erroneous part within the set of activated information. From this perspective, propositional validation involves four components: (1) a default process of affirming the validity of activated information, (2) a monitoring process that assesses the (in)consistency of activated information, (3) a reassessment process involving the recruitment of additional information to identify which belief component needs to be revised if there is inconsistency, and (4) an updating process of changing the subjective truth value of the identified belief component (Gawronski & Bodenhausen, 2014). Although propositional processes are sometimes described as controlled in the sense that they are intentional, conscious, effortful, and controllable, it is important to note that such a description oversimplifies the relation between the operating principles of the four process components and the conditions under which they operate (see Gawronski, Sherman, & Trope, 2014). For example, whereas the monitoring of inconsistency most often runs as a background process outside of conscious awareness, inconsistency between activated information usually raises conscious awareness which supports the reassessment of validity and the resolution of inconsistency (Morsella, Zarolina, & Gazzaley, 2012).

Proponents of single-process theories have criticized the associative-propositional distinction in dual-process theories of the expression of evaluative representations, arguing that all behaviors can be understood as the outcome of a single mental process. For example, within his parametric unimodel, Kruglanski argued that all judgments are the product of a single epistemic process of applying inferential rules to judgment-relevant information (e.g., Kruglanski & Gigerenzer, 2011; Kruglanski & Thompson, 1999). To account for varying judgment outcomes under different contextual conditions, the model proposes several continuous parameters that moderate the impact of rules and available information on overt judgments. Two central factors in the model are accessibility and relevance. Accessibility is assumed to determine whether a given rule or piece of information will be considered for a judgment; relevance is assumed to determine whether rules and information that are considered will actually be used for a judgment.

Although the unimodel has been proposed as a single-process alternative to various kinds of dual-process theories, we believe that its criticism of the associative-propositional duality is largely rooted in semantics rather than genuine theoretical disagreements. Both approaches acknowledge the fact that (1) stored information has to be considered in order to have an effect on judgments and (2) not all information that is considered will actually be used for a judgment. According to the unimodel, the consideration of available information is determined by the accessibility of that information, whereas the actual use of considered information is determined by its perceived relevance. Yet, although the theory specifies various contextual moderators of accessibility and relevance, it does not specify (1) the processes by which information becomes accessible and (2) the processes by which people assess the relevance of accessible information. Both processes are central in the associative-propositional duality, which provides detailed explanations for either outcome.[3] Whereas accessibility is determined by feature matching and spread of activation, relevance reflects the subjective validity of accessible information, which is determined by the monitoring and resolution of inconsistency between activated information. In other words, the unimodel simply states *that* judgments depend on accessibility and relevance, but it does not provide any explanation of *how* information becomes accessible and *how* accessible information is assessed for relevance. The latter issues are central to the associative-propositional duality, which aims to explain *why* certain information becomes accessible (and other information does not) and *why* certain accessible information is perceived as relevant (and other accessible information is not).

Another theoretical limitation of the unimodel is that it does not allow for the possibility that the process of assessing relevance (or validity) influences the accessibility (or activation) of information (e.g., selective memory retrieval resulting from confirmatory hypothesis-testing; see Peters & Gawronski, 2011b), a phenomenon captured by the hypothesis of mutual interactions between associative and propositional processes (Gawronski & Bodenhausen, 2006; Strack & Deutsch, 2004). The uninmodel also does not allow for the possibility that accessible information can influence behavior even when it is rejected as irrelevant. Within the unimodel, there is no direct pathway by which accessible information can influence behavior irrespective of its perceived relevance. Thus, if accessible information influences behavior, it must have been perceived as relevant according to the theory. This hypothesis is markedly different from the assumptions of the RIM, which suggests that accessible information can activate spontaneous approach-avoidance tendencies even when this information is rejected as invalid (Strack & Deutsch, 2004).

Evidence for dissociations between reflective judgments and impulsive reactions are typically dismissed by proponents of single-process theories as being due to different processing constraints. For example, whereas explicit measures usually provide ample time for a judgment, most implicit measures require fast responses under time pressure (see Gawronski & de Houwer, 2014). From the perspective of the unimodel, the differential time constraints may influence the perceived relevance of accessible information, such that a given piece of information may be deemed relevant under time pressure but not after longer delays when additional information can be taken into account (see also Cunningham, Zelazo, Packer, & van Bavel, 2007; Wojnowicz, Ferguson, Dale, & Spivey, 2009). Although we agree that time is an important determinant of both the relative amount of considered information and the relative complexity of potential inferences (see Gawronski & Bodenhausen, 2006), the implied equation of subjective relevance with behavioral effects makes any explanation of behavior in terms of relevance circular. That is, effects of accessible information on behavior are explained by its perceived relevance, but the only evidence for differences in perceived relevance is the effect of accessible information that needs to be explained (see Gawronski & Bodenhausen, 2015).

Another relevant single-process theory about the expression of evaluative representations is de Houwer's (2014) propositional account of responses on implicit measures. Drawing on a functional-cognitive framework for attitude research (de Houwer, Gawronski, & Barnes-Holmes, 2013), de Houwer argues that implicit measures assess automatic effects of stimuli on evaluative responses. In the attitude literature, such effects are typically explained in terms of associative processes, involving the automatic spread of activation from a target concept to mentally associated concepts. Yet, as noted by de Houwer et al. (2013), behavioral responses on implicit measures do not provide direct assessments of particular mental processes or representations (e.g., spread of activation between associated concepts). Instead, mental constructs provide explanations of observed behavioral effects, and these effects should not be equated with the theoretical constructs that are proposed to explain them. After all, it is entirely possible that behavioral responses on implicit measures are mediated by processes and representations that do not involve a spread of activation between associated concepts. One alternative discussed by de Houwer (2014) is that responses on implicit measures are mediated

by the automatic formation or activation of propositions. To support his argument, de Houwer reviews the results of several studies showing that implicit measures are sensitive to verbal instructions and information about how stimuli are related.

In response to de Houwer's arguments, it is important to note that all of the studies cited in support of his account involved variations in the experience with an attitude object. Although such manipulations provide valuable information about the processes underlying the *formation* of evaluative representations, they provide little information regarding the *expression* of evaluative representations. As noted by de Houwer et al. (2013), the latter question requires studies that compare the effects of a given stimulus across different contexts and across different kinds of evaluative responses while holding constant prior experiences with the stimulus. From this perspective, de Houwer's (2014) arguments do not speak to the processes involved in the expression of evaluative representations, but to the processes involved in their formation. Moreover, although the studies reviewed by de Houwer (2014) clearly demonstrate that verbal instructions and relational information can influence the formation of evaluative representations and their subsequent expression on implicit measures, they do not provide any counter-evidence against effects of stimulus co-occurrences that remain unqualified by relational information. After all, positive evidence for Hypothesis A is not the same as negative evidence against Hypothesis B (see Gawronski & Bodenhausen, 2015). As we noted in the second part of this chapter, there is ample evidence showing that co-occurrences between stimuli can influence evaluative representations irrespective of their relation (e.g., Gawronski et al., 2005; Hu et al., 2015; Langer et al., 2009; Moran & Bar-Anan, 2013). Moreover, simply stating *that* propositions can be activated automatically does not provide any explanation of *how* they are activated and *when* their activation occurs automatically. Associative accounts provide clear answers to both questions. The question of how evaluative representations are activated is addressed by the proposed roles of feature matching and spreading activation; the question of when activation occurs automatically is addressed by the assumption that repeated co-activation of the two concepts strengthens the mental link between the two concepts (Hebb, 1949). From this perspective, a dual-process approach seems superior in its explanatory and predictive power compared to single-process propositional accounts.

Conclusion

Since the publication of Strack and Deutsch's (2004) seminal article on reflective and impulsive determinants of human behavior, the associative-propositional duality has had an enormous impact on the field of psychology, including research on attitudes. Despite the insights provided by this research, the associative-propositional duality has been criticized for proposing two processes to explain attitudinal phenomena that can also be explained by a single propositional process. In the current chapter, we addressed this criticism by discussing

the different meanings of the associative-propositional duality in the attitudes literature. Distinguishing between the representation, formation, and expression of attitudes, our analysis suggests that some disagreements are the product of differing terminology (e.g., different terminology to describe the activation and validation of evaluative representations) whereas others are rooted in mischaracterizations of the criticized theories (e.g., inaccurate claims that associative networks are unable to represent the relation between objects). In cases where theoretical disagreements involve genuine empirical issues, there is substantial evidence supporting the joint operation of associative and propositional processes (e.g., the involvement of associative and propositional processes in the formation of evaluative representations). As we noted, single-process propositional theories may be revised to account for these findings in a post-hoc fashion, but the dual-process approach seems superior because it predicts them a priori without requiring the addition of ad hoc assumptions. Thus, the associative-propositional duality is alive and well when it is correctly interpreted in terms of process dualities in the formation and the expression of evaluative representations. Yet, criticism of the duality as describing distinct types of representational structures in long-term memory is based on a straw man that confuses dual-process theories with dual-representation theories.

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Notes

1 It is worth noting that even associatively represented co-occurrence involves relational information that may serve as a basis for propositions about states of affairs (e.g., an unqualified association between *lightning* and *thunder* as a basis for the proposition *lightning and thunder occur together*). From this perspective, the representation of relational content reflects a gradual feature involving different levels of complexity rather than a categorical difference between two distinct types of mental representations.

2 At this point, it is still unclear why validity information and relational information are differentially effective in qualifying the effect of observed co-occurrences. Preliminary findings suggest that processing goals may at least partly account for the obtained differences (Moran, Bar-Anan, & Nosek, 2015).

3 Somewhat ironically, Kruglanski and Gigerenzer (2011) use the term "two-step process" to describe the distinct roles of accessibility and relevance in the consideration and selection of information. Yet, they do not acknowledge that the two steps involve functionally distinct processes, which technically makes their theory a dual-process theory. A similar paradox can be found in neural network implementations of single-process theories. For example, some of these theories explicitly reject process dualities, but then propose two functionally distinct learning mechanisms, an associative-learning mechanism that captures regularities in the environment and an error-correcting learning mechanism that is based on inconsistencies between predictions of the network and observed events (e.g., Ehret, Monroe, & Read, 2015).

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