
CHAPTER 12

Formation, Change, and Contextualization of Mental Associations

Determinants and Principles of Variations in Implicit Measures

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Starting with the development of a new class of indirect measurement procedures in the mid-1990s, research using these procedures has produced a plethora of remarkable findings that has stimulated wide interest far beyond the traditional boundaries of social psychology.¹ People who consciously endorse egalitarian values tend to be quite astonished when they learn that their responses assessed by indirect procedures show racial bias (Nosek et al., 2007; see also Amodio, & Mendoza, Chapter 19, and Trawalter & Shapiro, Chapter 20, this volume); spontaneous behaviors that are difficult to predict with self-report measures revealed strong relations to implicit measures (Friese, Hofmann, & Schmitt, 2008; see also Perugini, Riche-*tin*, & Zogmaister, Chapter 14, this volume); and deliberate decisions with important real-life implications have been found to be predictable by response latency differences in the range of milliseconds obtained by indirect procedures (e.g., Galdi, Arcuri, & Gawronski, 2008; Green et al., 2007; von Hippel, Brener, & von Hippel, 2008; see also Bodenhausen & Todd, Chapter 15, this volume). Given the ubiquity of such findings, researchers became interested in potential sources of the mental associations assessed by indirect procedures, in particular the principles underlying their formation, change, and contextualization.

The present chapter reviews the literature on the formation, change, and contextualization of the mental associations assessed by indirect procedures. For this purpose, we first review the core assumptions of four prominent attitude theories, including their implications regarding the formation, change, and contextualization of mental associations. Expanding on this theoretical synopsis, the second part provides a comprehensive overview of the currently available evidence, which is used to evaluate the range and limits of the reviewed theories and to identify potential directions for future research.

THEORETICAL MODELS

The huge set of empirical findings in the literature on indirect procedures is certainly a challenge for any model that aims at explaining the formation, change, and contextualization of the associations assessed by these procedures. However, the more challenging task is to explain, and ideally predict, converging and diverging effects on explicit and implicit measures. For instance, whereas some studies have found effects on explicit but not implicit measures (e.g., Gawronski & Strack, 2004; Gregg, Seibt, & Banaji, 2006; Grumm, Nestler, &

von Collani, 2009), other studies report effects on implicit but not explicit measures (e.g., Dasgupta & Greenwald, 2001; Gawronski & LeBel, 2008; Gibson, 2008; Grumm et al., 2009; Karpinski & Hilton, 2001; Olson & Fazio, 2006). In addition, several studies have found converging effects on explicit and implicit measures (e.g., Gawronski & LeBel, 2008; Gawronski, Walther, & Blank, 2005; Grumm et al., 2009; Olson, & Fazio, 2001; Richeson & Nussbaum, 2004), whereas others have found antagonistic effects (e.g., Castelli, Tomelleri, & Zogmaister, 2008; Rydell, McConnell, Mackie, & Strain, 2006). In the following sections, we review four prominent attitude theories and their respective implications for the formation, change, and contextualization of attitudes. Even though these models have originally been designed for evaluative associations, many of their assumptions are equally applicable to nonevaluative domains, such as self-concepts and stereotypes.

The MODE Model

One of the earliest attitude theories addressing the difference between direct and indirect procedures is Fazio's MODE model (for recent reviews, see Fazio, 2007; Olson & Fazio, 2009). The theoretical core of the MODE model is the definition of *attitude* as the mental association between an object and one's summary evaluation of that object (Fazio, 2007). To the degree that this association is sufficiently strong, the evaluation associated with the object may be activated automatically when encountering that object (i.e., without intention to evaluate the object). According to the MODE model, automatically activated attitudes typically provide the basis for overt behaviors that are further downstream, such as the verbal report of an evaluation. However, the influence of automatically activated attitudes on downstream behaviors may be reduced when people have the motivation and the opportunity to engage in effortful processing. (MODE is the shortcut for Motivation and Opportunity as DEterminants.) Such effortful processes may involve a deliberation about specific attributes of the object or deliberate attempts to control for unwanted influences of automatically activated attitudes on downstream behavior. Thus, a central prediction of the MODE model is that downstream behaviors are influenced by automatically activated attitudes when either the motivation or the opportunity to engage in effortful processing is low. However, the impact of automatically activated attitudes will often be reduced when both motivation and opportunity are high.

Applied to the distinction between direct and indirect procedures, the MODE model argues that indirect procedures, such as evaluative priming (Fazio, Jackson, Dunton, & Williams, 1995; see Wentura & Degner, Chapter 6, this volume) or the Implicit Association Test (Greenwald, McGhee, & Schwartz, 1998; see Teige-Mocigemba, Klauer, & Sherman, Chapter 7, this volume), tend to reduce participants' opportunity to engage in effortful processing. As such, participants' responses on these procedures provide a good proxy for their automatically activated attitudes. Moreover, verbally reported evaluations assessed by direct procedures can be regarded as a particular kind of behavior that is further downstream. Thus, to the degree that participants lack the motivation and the opportunity to engage in effortful processing, explicit measures should reflect the same automatically activated attitudes that are reflected in implicit measures. If, however, participants have the motivation and the opportunity to engage in effortful processing, explicit measures may reflect whatever evaluation is implied by a person's deliberate inferences. These assumptions have been confirmed in a large number of studies showing that the correspondence between explicit and implicit measures is relatively high under conditions of impaired processing but tends to be low when both the motivation and the opportunity to engage in effortful processing are high (for a review, see Hofmann, Gschwendner, Nosek, & Schmitt, 2005; see also Hofmann & Wilson, Chapter 11, and Rydell & McConnell, Chapter 16, this volume).

Even though the MODE model was originally designed to explain attitude-behavior relations rather than the formation, change, and contextualization of attitudes, it has a number of important implications for converging versus diverging effects on explicit and implicit measures. First, experimentally induced differences on implicit measures can be expected whenever a given factor changes a person's object-evaluation association in memory, as it is implied in attitude formation or attitude change. If either the motivation or the opportunity to engage in effortful processing is low, the differences in automatically activated attitudes should also be reflected further downstream in verbally reported evaluations assessed by direct procedures. In this case, explicit and implicit measures should show corresponding effects (e.g., Gawronski & LeBel, 2008; Grumm et al., 2009; Olson, & Fazio, 2001; Richeson & Nussbaum, 2004). If, however, both motivation and opportunity are high, the impact of automatically activated attitudes on verbal self-reports may be reduced. In this case, explicit and

implicit measures should show a dissociation, such that implicit measures reflect the newly formed or recently changed attitude, whereas explicit measures reflect whatever evaluation is implied by a person's deliberate inferences (e.g., Gawronski & LeBel, 2008; Gibson, 2008; Grumm et al., 2009; Olson & Fazio, 2006).

Second, there may be cases in which a given manipulation influences participants' motivation and opportunity to deliberate about specific attributes of the object or to control for unwanted influences of automatically activated attitudes. In such cases, explicit and implicit measures will also show dissociations, such that explicit measures reveal the aforementioned variations arising from differences in motivation and opportunity, whereas implicit measures still show the original automatically activated attitude (e.g., Gregg et al., 2006). Finally, there may be combinations of the two influences that produce antagonistic effects on explicit and implicit measures (e.g., Castelli et al., 2008; Rydell et al., 2006), such that implicit measures show effects in one direction as a result of changes in automatically activated attitudes and explicit measures show opposite effects as a result of motivation and opportunity to engage in effortful processing. What is important in these three cases is that genuine changes of attitudes, defined as object-evaluation associations in memory (Fazio, 2007), should always be reflected in implicit measures. In contrast, variations in explicit measures may or may not reflect genuine changes in attitudes because they could also be driven by variations in participants' motivation and opportunity to engage in effortful processing.

Over and above these explanations for processes of attitude formation and change, it is important to note that the MODE model conceptualizes attitudes as associative knowledge structures in memory that are relatively stable over time and across contexts. Thus, according to the MODE model, variations in automatically activated attitudes as a function of contextual factors are rather unlikely. Nevertheless, the MODE model implies a number of assumptions that explain contextual variations in implicit measurement scores (e.g., Barden, Maddux, Petty, & Brewer, 2004; Blair, Ma, & Lenton, 2001; Dasgupta & Greenwald, 2001; Wittenbrink, Judd, & Park, 2001). First, the MODE model assumes that the particular attitude that is activated in response to a given stimulus depends on how that stimulus is categorized (Fazio, 2007). For instance, a black athlete may elicit a more favorable evaluation when he or she is categorized in terms of occupation rather than race (e.g., Mitch-

ell, Nosek, & Banaji, 2003). Thus, variations in implicit measurement scores may not necessarily indicate the storage of different attitudes toward the same person in memory but rather differing attitudes toward two different attitude objects (i.e., athletes vs. blacks). Second, the MODE model assumes that certain types of procedures are contaminated by extrapersonal associations (Olson & Fazio, 2004). Such extrapersonal associations are described as evaluative knowledge in a person's memory that does not contribute to that person's attitude. Even though some researchers question the feasibility of a clear definition of extrapersonal associations (Gawronski, Peters, & LeBel, 2008), Han, Olson, and Fazio (2006) have shown that some contextually induced variations in implicit measurement scores occur for some procedures but not others. In their study, evaluations that had been endorsed by other individuals in a brief video clip influenced participants' scores on a standard variant of the Implicit Association Test (Greenwald et al., 1998), even though a personalized variant of the Implicit Association Test (Olson & Fazio, 2004) and an evaluative priming task (Fazio et al., 1995) remained unaffected and in line with participants' self-reported evaluations. Thus, from the perspective of the MODE model, many of the frequently obtained context effects may not reflect a high context sensitivity of automatically activated attitudes but rather a high context sensitivity of particular measurement procedures.

The Dual-Attitudes Model

Another prominent model addressing the distinction between direct and indirect procedures is Wilson, Lindsey, and Schooler's (2000) dual-attitudes model. Basically, this model assumes that people often have two attitudes toward the same object stored in memory: an implicit attitude that is activated automatically and a second, explicit attitude that requires cognitive effort to be retrieved from memory. Similar to the MODE model, the dual-attitude model states that automatic, implicit attitudes generally influence responses on indirect procedures, whereas the impact of automatic, implicit attitudes on verbal self-reports depends on whether a person engages in the effortful process of retrieving an explicit attitude from memory. In the latter case, self-reported evaluations should primarily reflect a person's explicit attitude, which may not necessarily be in line with his or her automatic, implicit attitude.

A second central assumption of the dual-attitude model concerns the origin of explicit and

implicit attitudes. According to Wilson and colleagues (2000), implicit attitudes can be described as highly overlearned, relatively robust memory structures that have their roots in repeated long-term experiences with an attitude object. Explicit attitudes, in contrast, are more recently acquired memory structures that have not erased the old, implicit attitude from memory. Put differently, the dual-attitude model assumes that, when attitudes change, the old, implicit attitude still remains in memory, thereby influencing judgments and behavior when people are not able or motivated to engage in the effortful process of retrieving their new, explicit attitude from memory.

These assumptions have a number of implications for the formation, change, and contextualization of attitudes. First, the dual-attitude model states that the associations reflected in implicit measures are highly overlearned and stable. This assumption is in line with research showing relations between long-term socialization experiences and variations in implicit measures (e.g., Rudman, Phelan, & Heppen, 2007). However, it is at odds with other findings showing variations on implicit measures resulting from very little descriptive information (e.g., Gawronski, Walther, & Blank, 2005; Gregg et al., 2006). Second, the dual-attitude model implies that variations in explicit but not implicit measures should be the default case because old, implicit attitudes tend to be more robust than newly acquired, explicit attitudes. Again, this assumption is consistent with several studies showing effects on explicit but not implicit measures (e.g., Gawronski & Strack, 2004; Gregg et al., 2006; Grumm et al., 2009). However, it stands in contrast with several studies showing effects on implicit but not explicit measures (e.g., Gawronski & LeBel, 2008; Gibson, 2008; Grumm et al., 2009; Karpinski & Hilton, 2001; Olson & Fazio, 2006). Finally, the dual-attitudes model implies that simple context effects should be more likely for explicit measures because responses on these measures may vary as a function of whether people engage in the effortful process of retrieving their explicit attitude from memory. By contrast, contextual variations should be less likely for implicit measures, which presumably assess highly stable, implicit attitudes. These assumptions are supported by the large body of research on context effects on verbal self-reports (for a review, see Schwarz & Strack, 1991). However, they are inconsistent with the accumulating number of studies showing context effects on implicit measures (e.g., Barden et al., 2004; Blair et al., 2001; Dasgupta & Greenwald, 2001; Wittenbrink et al., 2001).

The Metacognitive Model

A relatively recent model addressing the distinction between direct and indirect procedures is Petty and Briñol's metacognitive model (MCM) of attitudes (Petty & Briñol, 2006; Petty, Briñol, & DeMarree, 2007). Drawing on Fazio's (2007) definition, the MCM conceptualizes attitudes as object-evaluation associations in memory. Moreover, in line with Wilson and colleagues' (2000) dual-attitudes model, the MCM assumes that old attitudes are not erased from memory but often coexist with newly formed attitudes. If the validity of an old attitude is challenged by a new attitude, the old attitude will be tagged as "false" or "wrong" with a negation tag. However, because associative links to negation tags are assumed to be weaker (at least initially) compared with the links between attitude objects and their evaluations, the impact of negation tags on judgments and behavior depends on whether people are motivated and able to engage in the effortful process of retrieving the negation tag from memory. Yet the old attitude and the new attitude may both be activated automatically, which may lead to neutral evaluations at the implicit level (e.g., de Liver, van der Pligt, & Wigboldus, 2007). Such neutral evaluations resulting from simultaneously activated, antagonistic attitudes tend to produce a state of implicit ambivalence, which often leads to enhanced elaboration of attitude-relevant information to reduce ambivalence (e.g., Petty, Tormala, Briñol, & Jarvis, 2006; Rydell, McConnell, & Mackie, 2008). In addition to conflict between old and new attitudes, implicit ambivalence can also result when people have opposite evaluative associations to an attitude object, such as when one's endorsed view conflicts with cultural associations that have never been endorsed but are nonetheless present (Petty & Briñol, 2009).

These assumptions have a number of implications for attitude formation and change. First, the MCM implies that explicit and implicit measures should show converging effects when all available information has the same evaluative implication. In this case, there are no negation tags that need to be stored or retrieved, and both explicit and implicit measures directly reflect a person's object-evaluation associations in memory. These conditions are characteristic of situations of attitude formation where the available information typically implies a particular evaluation of an attitude object. Second, converging effects may be expected when the available information is conflicting but both positive and negative information is regarded

as accurate. In this case, it is unlikely that one of the two evaluations is tagged as false, which, according to the MCM, is the primary cause of dissociations between explicit and implicit measures. In the MCM, this situation is referred to as one of explicit ambivalence. Third, corresponding effects can also be expected when the available information is conflicting and one piece of information leads to a rejection of the other, but people do not engage in the effortful process of retrieving the newly created negation tag from memory. In this case, both explicit and implicit measures should reflect a blend of the new and the unqualified old associations in memory. Fourth, the MCM implies the possibility of asymmetrical effects on explicit and implicit measures when an old attitude is qualified by new information and people engage in the effortful process of retrieving the newly created negation tag from memory when they verbally report an evaluation. In this case, verbal self-reports will be jointly determined by the negated old and the affirmed new associations, which both imply the same evaluative response. However, implicit measures will reflect a blend of the new association and the unqualified old association. In such cases, the overall valence of a person's response depends on the relative strength of the two associations. If the old association is stronger than the new one, the implicit measure will primarily reflect the valence of the old association. If, however, the new association is stronger than the old association, the implicit measure will primarily reflect the valence of the new association. Finally, if the two associations are equal in strength, the implicit measure will reflect a neutral evaluation, even though this evaluation will show the just-mentioned characteristics of implicit ambivalence (Petty et al., 2006).

As for context effects, the MCM shares the assumption of the MODE model that attitudes, defined as object–evaluation associations in memory, are relatively stable over time and across contexts. From this perspective, contextual variations in implicit measures seem rather unlikely. Instead, context effects should be more likely for explicit measures, where contextual factors may influence whether people engage in the effortful process of retrieving negation tags from memory. Nevertheless, Petty and colleagues (2007) explicitly addressed the possibility of contextual variations in implicit measures when the associative representation of an attitude object is heterogeneous and different context cues activate different subsets of stored associations (e.g., Barden et al., 2004; Dasgupta & Greenwald, 2001; Wittenbrink et al., 2001).

The Associative–Propositional Evaluation Model

Gawronski and Bodenhausen's (2006a, 2006b, 2007) associative–propositional evaluation (APE) model was designed specifically to integrate heterogeneous findings in the literature on the formation, change, and contextualization of implicit evaluations. The theoretical core of the APE model is the distinction between associative and propositional processes. *Associative processes* are defined as the *activation* of mental associations in memory, whereas *propositional processes* are defined as the *validation* of the information implied by momentarily activated associations. The critical difference between the two processes is their dependency on subjective truth or accuracy (see also Strack & Deutsch, 2004). Whereas the activation of associations in memory is independent of whether the information implied by these associations is considered accurate or inaccurate, processes of propositional validation are inherently concerned with assessing the validity of this information. Drawing on this distinction, implicit measures can be regarded as a proxy for the activation of associations in memory, unqualified by subjective truth or falsity. Explicit measures, in contrast, can be equated with the outcome of propositional validation processes, in that direct measurement procedures typically ask participants to indicate their endorsement of or agreement with a propositional statement (e.g., "Please rate how much you agree with the statement . . .").

Another central assumption of the APE model concerns the operating principles of associative and propositional processes. According to the APE model, the activation of associations is guided by principles of similarity and contiguity, which determine the particular pattern of associations that is activated in response to a given stimulus (see also Smith & DeCoster, 2000). Two central determinants of this process are (1) the preexisting structure of associations in memory and (2) the momentary set of input stimuli. The information implied by activated associations is further assumed to enter a propositional validation process, which is based on principles of logical consistency (Gawronski, Strack, & Bodenhausen, 2009). If the information implied by a given association is consistent with all momentarily considered information, this information will likely be regarded as valid and thus serve as a basis for a corresponding judgment. If, however, the information implied by a given association is inconsistent with other information, this inconsistency needs to be resolved

in order to avoid aversive feelings of cognitive dissonance (Festinger, 1957). Importantly, such inconsistency-related "negations" do not necessarily deactivate the association that underlie a rejected proposition (e.g., a rejection of the statement "Old people are bad drivers" does not necessarily deactivate the concepts of old people and bad drivers; see Deutsch, Gawronski, & Strack, 2006; Gawronski, Deutsch, Mbirikou, Seibt, & Strack, 2008). Thus, according to the APE model, inconsistency within the momentarily considered set of information functions as the primary determinant of potential dissociations between explicit and implicit measures (e.g., Gawronski, Peters, Brochu, & Strack, 2008). Moreover, given that the likelihood of inconsistency increases as a function of the amount of information that is considered, dissociations between explicit and implicit measures should increase as a function of cognitive elaboration (e.g., Hofmann, Gawronski, Gschwendner, Le, & Schmitt, 2005).

Another theoretical assumption that seems important in the present context concerns the mutual interplay between associative and propositional processes. According to the APE model, activated associations typically serve as the basis for explicit judgments, unless the information implied by these associations is rejected because of its inconsistency with other momentarily considered information. This assumption implies an influence of associative processes on propositional processes. Moreover, propositional validation processes may sometimes activate new associations in memory, for instance via intentional retrieval processes (e.g., Blair et al., 2001). This assumption implies an influence of propositional processes on associative processes. According to Gawronski and Bodenhausen (2006a), the first case should be reflected in an indirect effect on explicit measures that is mediated by implicit measures. In contrast, the second case implies an indirect effect on implicit measures that is mediated by explicit measures.

These assumptions have a number of implications for the formation, change, and contextualization of the associations assessed by indirect procedures. First, the formation of new associations in memory may occur via two different learning mechanisms: (1) associative learning, which is driven by the mere co-occurrence of objects or events, and (2) propositional learning, which is based on conscious insights into the validity of observed relations (Gawronski & Bodenhausen, 2009). These two processes may run simultaneously or in isolation, leading to different outcomes in each of the possible combinations (Gawronski

& Bodenhausen, 2006a). For instance, if associative learning creates a new association in memory and this association is regarded as valid, implicit and explicit measures should show corresponding effects, with the effect on the explicit measure being mediated by the implicit measure (e.g., Grumm et al., 2009; Olson & Fazio, 2001; Whitfield & Jordan, 2009; see Gawronski & Bodenhausen, 2006a). Conversely, if a new association results from propositional learning, implicit and explicit measures should again show corresponding effects. However, in this case, the effect on the implicit measure should be mediated by the explicit measure (e.g., Gawronski & Walther, 2008; Whitfield & Jordan, 2009). Moreover, if associative learning creates a new association in memory but this association is rejected as invalid because of its inconsistency with other information, effects should emerge only on the implicit measure and not on the explicit measure (e.g., Gawronski & LeBel, 2008; Gibson, 1998; Grumm et al., 2009; Karpinski & Hilton, 2001; Olson & Fazio, 2006). Finally, if new information produces inconsistency in the momentarily considered set of information and this inconsistency leads to a rejection of a stored association, effects should emerge only on the explicit measure and not on the implicit measure (e.g., Gawronski & Strack, 2004; Gregg et al., 2006; Grumm et al., 2009).

The aforementioned principles integrate a wide range of empirical findings on the formation and change of the associations assessed by indirect procedures (Gawronski & Bodenhausen, 2006a). Over and above these principles, the APE model has a number of implications for context effects. Specifically, it assumes that a given stimulus does not necessarily activate all mental associations pertaining to that stimulus. Instead, the pattern of associations that is activated in response to a given stimulus depends on the overall set of input stimuli, which also includes context cues and other types of contextual information (e.g., Barden et al., 2004; Dasgupta & Greenwald, 2001; Wittenbrink et al., 2001). What is critical in such cases is the contingency of a given context cue and the particular type of information during the formation of an association (see Schmajuk & Holland, 1998). These assumptions can be illustrated by the findings of Rydell and Gawronski (2009). In their study, newly formed associations generalized across different contexts when the available information about the attitude object was homogeneous. However, when this information was subsequently challenged by evaluatively incongruent information, evaluative responses became context

sensitive such that they reflected the contingency between the valence of the available information and the context in which this information had been acquired. In other words, after the representation of the attitude object had become evaluatively heterogeneous, context cues determined which subset of associations became activated in response to that object, thereby leading to contextual variations in implicit evaluations.

EMPIRICAL EVIDENCE

Many of the assumptions made by the reviewed theories have been empirically confirmed, whereas others are more difficult to reconcile with the available evidence. In the remainder of this chapter, we provide a comprehensive review of the available literature on the formation, change, and contextualization of mental associations as assessed by indirect procedures. Over and above construct-related effects, this section also addresses the possibility of method-related effects, which implies that some experimentally created effects may be driven by particular features of the measurement procedures rather than genuine variations in the underlying construct. Because of space constraints, we refrain from in-depth discussions of methodological details of the reviewed studies. Instead, we focus on the comprehensive nature of this review by providing brief summaries of the basic findings.

Formation

Socialization Experiences

Starting with the development of indirect procedures, there has been a strong intuitive belief that these procedures may tap memory traces that have their roots in long-term socialization experiences (Greenwald & Banaji, 1995; Wilson et al., 2000; see also Olson & Dunham, Chapter 13, this volume). A number of studies provide support for this assumption. For example, Rudman and colleagues (2007) showed that implicit evaluations of smoking and body weight were uniquely predicted by early childhood experiences, whereas explicit evaluations were uniquely predicted by recent experiences. Investigating the relationship between parental racial attitudes and implicit prejudice in children, Sinclair, Dunn, and Lowery (2005) found a strong correspondence among attitudes for children who strongly identified with their parents but not for those who weakly identified with their parents. Similar results are reported by Sherman, Chassin,

Presson, Seo, and Macy (2009), who provided evidence for an intergenerational transmission of implicit smoking evaluations from mothers to their children, with transmitted smoking evaluations in children predicting smoking initiation 18 months later. Applying the notion of socialization experiences to implicit self-esteem, DeHart, Pelham, and Tennen (2006) found that children's levels of implicit self-esteem was positively related to nurturing parenting styles and negatively to overprotective parenting styles. Along similar lines, Kim, Sarason, and Sarason (2006) found that young Koreans in the United States showed higher levels of implicit positivity toward their ethnic ingroup as a function of positive self-reported parent-child relationships, which, in turn, predicted lower levels of self-reported distress.

Social Contact

Closely related to the notion of socialization experiences is the contact hypothesis (Allport, 1954), which states that enhanced contact between social groups reduces intergroup conflict, at least when certain boundary conditions are met (for a meta-analysis, see Pettigrew & Tropp, 2006). Investigating the effects of contact on implicit group evaluations, Henry and Hardin (2006) showed that friendly intergroup contact reduced implicit prejudice of blacks toward whites and Muslims toward Christians. However, they did not find any evidence for contact-related prejudice reductions in whites' attitudes toward blacks and Christians' attitudes toward Muslims. Turner, Hewstone, and Voci (2007) provided more encouraging evidence, showing that exposure to South Asians was related to more favorable implicit evaluations of South Asians in white elementary school children. Investigating implicit group biases in targets of prejudice, Livingston (2002) found that black participants showed higher levels of implicit negativity toward their ingroup as a function of increased contact with whites. Moreover, this relation was mediated by perceived negativity from whites toward blacks, such that black participants' implicit negativity toward their ingroup increased as a function of greater perceived negativity in whites. Interestingly, the opposite was true for explicit evaluations, such that perceived negativity in whites was associated with increased (rather than decreased) positivity toward the ingroup among blacks.

Challenging the idea that implicit measures may reflect early socialization experiences, Towles-Schwen and Fazio (2001) found that implicit racial prejudice of whites against blacks was reduced by

positive interaction experiences only when these experiences were recent. Expanding on these findings, Shook and Fazio (2008) showed that white students who had been randomly assigned to share a dormitory room with a black roommate showed lower levels of implicit prejudice compared with white students who had been assigned to share a room with a white student. Interestingly, these effects emerged even though students in interracial rooms reported less satisfaction and less involvement with their roommates compared with students in same-race rooms.

Descriptive Information

Even though the empirical findings reviewed thus far largely support the assumption that implicit measures are influenced by long-term socialization experiences (but see Towles-Schwen & Fazio, 2001), the reverse conclusion—that variations in implicit measures generally reflect such experiences—is not necessarily correct (Gawronski, 2009). In fact, several studies show that implicit measures are influenced by a number of relatively simple factors that do not require repeated or long-term experiences. One example is research that has used verbal descriptions to create positive or negative implicit evaluations of individuals or social groups (e.g., Gawronski, Walther, & Blank, 2005; Gregg et al., 2006; Rydell & McConnell, 2006; Rydell, McConnell, Strain, Claypool, & Hugenberg, 2007). Some of these studies showed large effect sizes with as few as three statements (e.g., Gawronski, Walther, & Blank, 2005) or mere suppositions instead of factual descriptions (e.g., De Houwer, 2006a; Gregg et al., 2006). Drawing on the notion of cognitive balance (Heider, 1958), Gawronski, Walther, and Blank (2005) found that descriptive information about the relationship between two individuals created implicit evaluations that can be described as balanced when participants formed a positive or negative attitude toward one of the two individuals before they learned about their relationship. However, newly created implicit evaluations tended to be imbalanced when participants first learned about the relationship between two individuals and then formed a positive or negative attitude toward one of them afterward.

Evaluative Conditioning

Another set of studies have used procedures that are commonly used in research on evaluative conditioning (EC). In a typical EC study, a neutral conditioned stimulus (CS) is repeatedly paired

with either a positive or a negative unconditioned stimulus (US). As a result, the CS tends to acquire the valence of the US, such that CSs that are repeatedly paired with positive USs acquire a positive valence and CSs that are repeatedly paired with negative USs acquire a negative valence (for a review, see De Houwer, Thomas, & Baeyens, 2001). Such EC effects have also been demonstrated for implicit measures (e.g., Boschen, Parker, & Neumann, 2007; Hermans, Baeyens, Lamote, Spruyt, & Eelen, 2005; Hermans, Vansteenwegen, Crombez, Baeyens, & Eelen, 2002; Mitchell, Anderson, & Lovibond, 2003; Olson & Fazio, 2001, 2002; Petty et al., 2006; Woud, Becker, & Rinck, 2008). Relating the notion of EC to the development of racial prejudice, Livingston and Drwecki (2007) found that white participants who do not show any racial bias on implicit measures were significantly less likely to acquire negative associations in a standard EC paradigm, suggesting that EC-related mechanisms may be at least partially responsible for the high levels of implicit prejudice obtained in earlier studies (e.g., Nosek et al., 2007).

Self-Anchoring

Expanding the notion of EC to self-associations, Walther, Nagengast, and Trasselli (2005) argued that the self may often function as a US, such that objects that become associated with the self acquire the valence of the self (see also Greenwald & Banaji, 1995). Thus, given that most people show a positive evaluation of themselves (e.g., Bosson, Swann, & Pennebaker, 2000; Greenwald & Farnham, 2000; Koole, Dijksterhuis, & van Knippenberg, 2001), any object that becomes associatively linked with the self may acquire a positive valence (see also Greenwald, Banaji, et al., 2002). Consistent with this assumption, Gawronski, Bodenhausen, and Becker (2007) showed that implicit evaluations of newly acquired objects become more positive as a function of ownership, and the size of this effect was positively related to implicit evaluations of the self. These effects were obtained regardless of whether ownership resulted from a choice decision or a random procedure (see also Gawronski & LeBel, 2008; Prestwich, Perugini, Hurling, & Richetin, 2010).

Category Membership

Similar considerations can be applied to self-related associations resulting from group membership. Several studies showed that mere categorization as a member of an unfamiliar, meaningless

group (see Tajfel, Billig, Bundy, & Flament, 1971) is sufficient to create an implicit preference for ingroups over outgroups (e.g., Ashburn-Nardo, Voils, & Monteith, 2001; Castelli, Zogmaister, Smith, & Arcuri, 2004; DeSteno, Dasgupta, Bartlett, & Cajdric, 2004; Otten & Wentura, 1999; Paladino & Castelli, 2008; see also Van Bavel & Cunningham, 2009). According to Walther and colleagues' (2005) theorizing, these effects may be due to an associative transfer of self-evaluations to the new ingroup (see also Cadinu & Rothbart, 1996; Gramzow & Gaertner, 2005; Otten & Wentura, 2001). Going beyond explicit categorization, a number of studies by Greenwald and colleagues (Greenwald, Pickrell, & Farnham, 2002; Pinter & Greenwald, 2004) showed that merely studying the names of the members of a hypothetical group enhanced implicit positivity toward the group. These effects were associated with parallel increases in group-related associations to the self, suggesting that the formation of implicit group evaluations is due to an associative transfer of positive self-evaluations to the group.

Investigating the interplay between group and exemplar evaluations, Ranganath and Nosek (2008) found that evaluative information about a given exemplar quickly generalized to the exemplar's social group at the implicit level, whereas generalization at the explicit level occurred only after a delay of several days. According to the authors, these findings indicate that simple associative links between an exemplar and a social group are sufficient for attitude generalization at the implicit level, and that memory-based monitoring processes can reduce association-related generalizations at the explicit level. Similar findings were obtained by Castelli and colleagues (2004), who showed that implicit group evaluations generalize to implicit evaluations of the members of these groups even when participants failed to remember the exemplars' group membership.

Salient Cues

Further evidence that implicit evaluations may be the product of quickly activated associative links is provided by several studies showing that implicit evaluations of unfamiliar individuals vary as a function of salient facial cues that are associated with either a positive or a negative valence. Van Leeuwen and Macrae (2004), for example, found that unfamiliar attractive faces elicited more favorable implicit evaluations than unfamiliar unattractive faces, despite the absence of any other

information about these faces (see also Olson & Marshuetz, 2005). In a similar vein, Richetin, Croizet, and Huguet (2004) showed that female faces elicited more favorable implicit evaluations when they were wearing makeup than when they were not. Investigating potential conflicts between facial cues and descriptive information, McConnell, Rydell, Strain, and Mackie (2008) found that associative cues related to attractiveness, obesity, and race outweighed the impact of verbally presented behavioral information, such that these group-associated cues influenced implicit evaluations despite the availability of alternative information of the opposite valence. Similar effects of attractiveness cues and verbal information about ambition were obtained by Sritharan, Heilpern, Wilbur, and Gawronski (in press) in an online dating context.

Summary

Even though there is evidence that early socialization experiences can contribute to variations in implicit measures, there is accumulating evidence that the associations assessed by indirect procedures can be formed rather quickly and with relatively little effort. Findings of the latter kind challenge theorizing that implicit measures reflect highly overlearned associations that require long-term experiences for their formation (cf. Wilson et al., 2000). Aside from this inconsistency with a particular type of model, the reviewed theories are doing fairly well in explaining the available evidence on the formation of mental associations. However, most of these explanations have the status of post-hoc interpretations rather than a priori predictions. Future research investigating the applicability of core principles in the learning literature (e.g., Rescorla & Wagner, 1972) would be a useful avenue that could provide deeper insights into the formation of mental associations assessed by indirect procedures as well as potential differences to self-reports.

Change

Going beyond the formation of mental associations, many researchers have become interested in whether and how associations can be changed once they are formed. Interestingly, this research is much more heterogeneous than the reviewed evidence on formation in that some manipulations turned out to be more effective in producing changes on explicit compared with implicit measures, whereas other manipulations were more

effective in producing changes in implicit compared with explicit measures (see also Gawronski & Bodenhausen, 2006a).

Evaluative Conditioning

Drawing on earlier evidence for EC effects in the formation of implicit evaluations, a number of studies have shown that repeated pairings of CSs and USs can also be used to change implicit evaluations. For instance, using self-related words as CSs in a subliminal EC paradigm, Dijksterhuis (2004) found higher levels of implicit self-esteem when self-related words were repeatedly paired with positive words than when they were repeatedly paired with neutral words (see also Grumm et al., 2009). Along the same lines, Baccus, Baldwin, and Packer (2004) obtained EC-related variations in implicit self-esteem when self-relevant words were repeatedly paired with pictures of smiling, frowning, or neutral faces in a computer game. Similar effects have been found for various other attitude objects, including young and old people (Karpinski & Hilton, 2001), black and white faces (Olson & Fazio, 2006), different continents (Gawronski & LeBel, 2008), and consumer brands (Gibson, 2008). Interestingly, all of these studies found EC effects on implicit measures, even though explicit measures were unaffected. These findings stand in contrast to research on attitude formation, where EC effects have typically been demonstrated for both explicit and implicit measures (e.g., Olson & Fazio, 2001). To our knowledge, only two studies have found parallel EC effects on both explicit and implicit measures in a context of attitude change: one by Gawronski and LeBel (2008) and the other by Grumm and colleagues (2009). In both of these studies, EC effects emerged on both explicit and implicit measures when participants were asked to introspect on their feelings before they completed the self-report measure. However, EC-related pairings influenced only implicit but not explicit measures when participants were asked to introspect on their knowledge about the attitude object (Gawronski & LeBel, 2008; Grumm et al., 2009).

Approach-Avoidance

Some researchers have argued that repeated pairings of a neutral stimulus with either positive or negative motor actions (e.g., approach vs. avoidance movements) can be used to induce EC-related variations in implicit evaluations (e.g., Woud et al., 2008). This idea has also been applied to

the context of attitude change. In a series of studies, Kawakami, Phills, Steele, and Dovidio (2007) found significant reductions in implicit prejudice against blacks when participants had to respond repeatedly with an approach action to black faces and with an avoidance action to white faces. In line with Walther and colleagues' (2005) speculations about EC effects resulting from self-associations, a follow-up study by Kawakami, Steele, Cifa, Phills, and Dovidio (2008) showed that these effects accompanied enhanced associations between the attitude object and the self. Other research using a similar rationale found that participants who were surreptitiously induced to smile while viewing photographs of black people showed lower levels of implicit prejudice compared with participants who viewed white faces while engaging in the same facial expression and control participants who were not induced to smile (Ito, Chiao, Devine, Lorig, & Cacioppo, 2006).

US Revaluation

Drawing on the idea of US revaluation in EC (Baeyens, Eelen, Van den Bergh, & Crombez, 1992; Rescorla, 1974), Walther, Gawronski, Blank, and Langer (2009) demonstrated that subsequent changes in the valence of a positive or negative US led to corresponding changes in implicit evaluations of a previously associated CS. In their study, neutral faces (CS) were repeatedly paired with either positive or negative faces (US). Immediately afterward, the original valence of the USs was reversed by means of descriptive statements of the opposite valence; participants in a control condition were presented with neutral statements about the US faces. Results showed that both explicit and implicit evaluations of the CSs changed in line with the new evaluations of the USs, even though the CSs had never been presented with any new information.

Persuasion

Given that most indirect measurement procedures have been developed by social psychologists, and given that social psychological research on attitude change in the past decades has been dominated by the persuasive communication paradigm (e.g., Chen & Chaiken, 1999; Kruglanski & Thompson, 1999; Petty & Wegener, 1999), it seems somewhat surprising that hardly any research has investigated changes in implicit evaluations from a persuasion point of view (for a discussion of several unpub-

lished studies, see Petty & Briñol, Chapter 18, this volume). A well-replicated finding in persuasion research is that under conditions of low cognitive elaboration attitudes tend to be influenced more strongly by peripheral/heuristic cues of the persuasive message (e.g., source attractiveness, source expertise, consensus information) rather than central/systematic features (i.e., argument strength). Conversely, under high cognitive elaboration attitudes tend to be more influenced by central/systematic features, whereas the impact of peripheral/heuristic is often attenuated (but see Kruglanski & Thompson, 1999). To our knowledge, only two published studies have investigated changes in implicit evaluations in a standard persuasion paradigm (Briñol, Horcajo, Becerra, Falces, & Sierra, 2002; Tormala, Briñol, & Petty, 2004). These studies showed that strong arguments resulted in more favorable implicit evaluations compared with weak arguments; explicit evaluations were unaffected by argument strength. Neither of these two studies included a manipulation of cognitive elaboration or peripheral/heuristic cues.

Information about the potential impact of peripheral/heuristic cues can be derived from two studies that investigated effects of celebrity voice-overs (Forehand & Perkins, 2005) and consensus information (Sechrist & Stangor, 2001). Using a paradigm similar to commercial advertising, Forehand and Perkins (2005) found that celebrity endorsement of a product influenced implicit product evaluations in line with participants' attitudes toward the celebrity. Explicit product evaluations showed similar effects unless participants were able to identify the celebrity. In fact, when participants were able to identify the celebrity, the originally positive correlation between celebrity attitude and explicit product evaluation turned into a negative correlation. Investigating the effects of consensus information on implicit stereotypes, Sechrist and Stangor (2001) found that preexisting implicit stereotypes were enhanced when participants learned that other individuals shared that stereotype than when the stereotype was not shared by other individuals.

Cognitive Dissonance

Using Festinger and Carlsmith's (1959) induced compliance paradigm, Gawronski and Strack (2004) investigated the differential effects of cognitive dissonance on explicit and implicit evaluations arising from counterattitudinal behavior. In line with a conceptualization of cognitive consistency as an inherently propositional phenomenon

(Gawronski et al., 2009), their results showed that dissonance influenced explicit but not implicit evaluations (for similar findings, see Wilson et al., 2000). Moreover, explicit and implicit evaluations were significantly correlated under control conditions and when participants had a situational explanation for their counterattitudinal behavior. However, correlations tended to be negative, albeit nonsignificant, when participants did not have a situational explanation and, therefore, changed their explicit evaluations as a result of cognitive dissonance (see also Gawronski, Peters, Brochu, & Strack, 2008).

Descriptive Information

Drawing on the idea that descriptive verbal information can provide a basis for newly formed implicit evaluations, several studies have investigated the range and the limits of descriptive information in changing implicit evaluations. For instance, Petty and colleagues (2006) showed that descriptive information is capable of reversing newly formed explicit evaluations that have been created by means of an EC manipulation. However, implicit evaluations seemed to integrate the information of both EC-related pairings and descriptive information, such that subsequent implicit evaluations were only neutralized rather than reversed. Similar effects were reported by Rydell and colleagues (2007), who showed that counterattitudinal information quickly reversed explicit evaluations, whereas implicit evaluations displayed rather slow, incremental changes as a function of increasing counterattitudinal information (see also Rydell & McConnell, 2006). One of the most interesting studies in this context has been conducted by Rydell and colleagues (2006), who combined CS-US pairings in a subliminal EC paradigm with descriptive information about the CS that was opposite to the valence of the US. Their results showed that implicit evaluations of the CS were uniquely influenced by the valence of the US with which it was paired, but not by the descriptive information about the CS. In contrast, explicit evaluations of the CS were uniquely influenced by the descriptive information, but not by EC-related pairings to positive or negative USs.

Negation

Testing the effectiveness of a training paradigm to reduce implicit stereotyping, Kawakami, Dovidio, Moll, Hermsen, and Russin (2000) presented their participants with pairings of faces and adjectives

that formed either stereotypical or counterstereotypical pairs (e.g., a black face combined with either a stereotypically black or a stereotypically white trait). Participants were asked to press a no key each time they saw a stereotype-congruent combination and a yes key each time they saw a stereotype-incongruent combination. Over a series of several hundred trials, Kawakami and colleagues found that implicit stereotyping was significantly reduced over the course of the task. However, drawing on earlier findings showing counterintentional effects of negations (e.g., Deutsch et al., 2006; Gilbert, 1991), Gawronski, Deutsch, Mbirikou, Seibt, and Strack (2008) showed that reductions in implicit stereotyping are primarily driven by the affirmation of counterstereotypes rather than the negation of stereotypes. In fact, repeated negations of a stereotype resulted in ironic effects, such that negation training increased rather than decreased implicit stereotyping. Similar ironic effects have been obtained by Payne, Lambert, and Jacoby (2002), who found that instructions to ignore race as a cue in a sequential priming measure of race bias in weapon identification (Payne, 2001) increased (rather than reduced) the impact of race. From a general point of view, these results suggest that affirming alternative associations may be more effective in producing the intended outcome than negating unwanted associations. This conclusion is in line with findings by both Sassenberg and Moskowitz (2005), who showed that a procedural priming manipulation to "think different" effectively reduced implicit stereotyping, and Stewart and Payne (2008), who demonstrated similar effects for implementation intentions to think in a counterstereotypical manner.

The differential effectiveness of negation in qualifying explicit and implicit evaluations is also reflected in a study by Gregg and colleagues (2006). In their study, participants received verbal descriptions of two groups, one of which was described as positive and the other as negative. After participants completed measures of explicit and implicit group evaluations, they were told that the experimenter had mistakenly mixed up the conditions and that the information about the two groups should have been reversed. Participants were then asked to mentally reverse the information they have seen before and to complete the two measures again. Results showed that reversal instructions effectively reversed explicit evaluations, whereas implicit evaluations still reflected the valence of the original descriptions about the two groups.

Media Influences

Addressing influences in real-life settings, a number of studies have investigated potential effects of TV clips on mental associations. For instance, Dal Cin, Gibson, Zanna, Shumate, and Fong (2007) found that watching movie clips featuring a cigarette-smoking protagonist enhanced self-smoking associations and self-reported intentions to smoke, and this effect increased as a function of identification with the protagonist. Evaluating the effectiveness of anti-marijuana and anti-tobacco TV advertisements, Czyzewska and Ginsburg (2007) found that the campaigns evaluated in their study effectively increased implicit negativity toward tobacco and marijuana. However, the anti-marijuana campaigns produced ironic effects at the explicit level, in that participants who watched them showed the most favorable attitudes toward marijuana. Lincoln, Arens, Berger, and Rief (2008) investigated the effects of different kinds of anti-stigma campaigns, showing that implicit schizophrenia stereotypes can be effectively reduced by campaigns that emphasize either biogenetic or psychosocial causes of schizophrenia.

Interventions

Adopting a similar focus on real-life settings, several studies have used indirect procedures to evaluate various kinds of interventions. For instance, Teachman and Woody (2003) found that cognitive-behavioral therapy effectively reduced implicit fear associations in spider phobics, and these reductions were associated with parallel effects at the behavioral level. Similar results were obtained by Grumm and colleagues (2008) for the impact of cognitive-behavioral psychotherapy on implicit pain associations in patients suffering from chronic pain. Across two quasi-experiments, Rudman, Ashmore, and Gary (2001) reported evidence for the effectiveness of a diversity education seminar in reducing explicit and implicit prejudice. Along the same lines, Dasgupta and Asgari (2004) found that academic environments with enhanced exposure to female leaders effectively reduced implicit gender stereotyping. Evaluating the effectiveness of a social competence training program in reducing aggressive behavior, Gollwitzer, Banse, Eisenbach, and Naumann (2007) obtained no differences between intervention and control groups immediately after the training program, with both groups showing a significant decrease from pretest to posttest. However, control participants showed a significant rebound in implicit and explicit ag-

gressiveness 4 months after the intervention, whereas the intervention group did not. Plant and Peruche (2005) evaluated the effectiveness of a training program designed to reduce racial bias in police officers' tendency to shoot at unarmed suspects, showing that a training task in which race was unrelated to the presence of a weapon effectively reduced racial bias (see also Plant, Peruche, & Butz, 2005).

Summary

The available evidence shows that, once formed, the associations assessed by indirect procedures can indeed be changed. However, different manipulations seem to vary in their relative effectiveness, with some being more effective in producing changes on explicit rather than implicit measures (e.g., Gawronski & Strack, 2004; Gregg et al., 2006; Grumm et al., 2009) and others being more effective in producing changes on implicit rather than explicit measures (e.g., Gawronski & LeBel, 2008; Gibson, 2008; Grumm et al., 2009; Karpinski & Hilton, 2001; Olson & Fazio, 2006). The first outcome—changes in explicit but not implicit measures—can be easily explained by all of the reviewed theories, albeit with nontrivial differences in their particular interpretations (Fazio, 2007; Gawronski & Bodenhausen, 2006a; Petty et al., 2007; Wilson et al., 2000). The latter outcome—changes in implicit but not explicit measures—seems difficult to reconcile with theories claiming that implicit measures reflect old, highly overlearned associations that have not been replaced by more recently acquired associations (cf. Wilson et al., 2000). However, the results can be explained by the majority of other theories, although again with nontrivial differences in their particular interpretations (Fazio, 2007; Gawronski & Bodenhausen, 2006a; Petty et al., 2007). In addition, it seems worth noting that some studies showing parallel effects on explicit and implicit measures provided evidence for particular mediation patterns (e.g., Galdi et al., 2008; Gawronski & Walther, 2008; Whitfield & Jordan, 2009; see also Gawronski & Bodenhausen, 2006a). Even though some of these mediations can be explained by the MODE model (i.e., changes in object-evaluation associations that are subsequently used for self-reported evaluations should produce an indirect effect on explicit measures that is mediated by implicit measures), the prediction of indirect effects on implicit measures that are mediated by explicit measures is a unique implication of the APE model. So far, the particular conditions of

the obtained mediation patterns are in line with the assumptions of APE model, providing a preliminary advance of this theory in accounting for the available data.

Context Effects

Even though most of the studies reviewed thus far did not include follow-up assessments at a later point (for notable exceptions, see Gollwitzer et al., 2007; Kawakami et al., 2000; Olson & Fazio, 2006; Walther et al., 2009), the general assumption in these studies is that the obtained results reflect stable effects that remain robust over time. Deviating from the focus on long-term changes, a number of studies have investigated effects that may be regarded as momentary shifts as a function of the particular context. The assumption underlying these studies is that variations in the particular context influence the type of associations that are momentarily activated, which, in turn, should influence performance on indirect procedures.

Accessible Information

The most representative set of studies in this context has investigated the impact of momentarily accessible information on implicit measures. In one of the first studies on context effects, Dasgupta and Greenwald (2001) showed that exposure to liked and disliked exemplars can shift implicit prejudice scores (see also Dasgupta & Rivera, 2008). Blair and colleagues (2001) showed similar effects for self-generated information. In their study, participants who were instructed to vividly imagine a counterstereotypical woman showed reduced levels of implicit gender stereotyping compared with participants instructed to imagine a stereotypical woman and participants in a control condition. Similar results are reported by Sassenberg and Wieber (2005), who found less favorable implicit evaluations of an ingroup category when participants were asked to recall a situation when they were angry about their ingroup versus a situation when they were happy about their ingroup. However, qualifying the generality of such effects, Gawronski and Bodenhausen (2005) found decreased levels of implicit stereotyping only when the retrieval of counterstereotypical information was easy (i.e., a low number of examples) but not when the retrieval task was difficult (i.e., a high number of examples). This finding resembles the well-replicated ease-of-retrieval effect (Schwarz et al., 1991), showing that explicit judgments are influenced by the experienced ease of retrieving

information from memory rather than the actual content of that information. Note, however, that such ease-of-retrieval effects were obtained only for a particular type of procedure, whereas other procedures showed the expected effects of mere accessibility; we return to these findings in the context of method-related effects.

Investigating potential effects of momentarily accessible information on implicit self-esteem, Glen and Banse (2004) did not find any evidence for variations resulting from interviews focusing on personal deficits versus personal strengths. Similar null effects are reported by Grumm and colleagues (2009) for a directed-thinking task that involved the retrieval of positive or negative personal characteristics, which influenced only explicit, and not implicit, self-esteem. A manipulation by Stapel and Blanton (2004) appears to be more effective in shifting implicit self-esteem scores. These authors found significant variations in implicit self-esteem as a function of subliminally primed comparison standards.

Context Cues

Another set of studies investigated whether the presence of simple context cues can produce variations in implicit measures. For instance, Wittenbrink and colleagues (2001) have shown that implicit evaluations of blacks vary as a function of the background context against which the target is presented (e.g., family barbecue vs. graffiti wall). Expanding on these findings, Barden and colleagues (2004) showed that it is not the context *per se* but rather the social role within that context that influences implicit evaluations (see also Maddux, Barden, Brewer, & Petty, 2005). In their study, implicit evaluations of the same black target presented in a prison context varied as a function of whether the target's clothing suggested the role of prisoner or lawyer. Investigating the role of acoustic cues, Rudman and Lee (2002) found higher levels of implicit prejudice against African Americans when participants were exposed to violent or misogynistic rap music. Moreover, Schaller, Park, and Mueller (2003) showed that ambient darkness led to higher levels of implicit prejudice against black people for participants with chronic beliefs in a dangerous world, but not for participants who did not believe in a dangerous world. Studying the importance of context cues in the domain of eating behavior, Roefs and colleagues (2006) showed that momentary associations of high-fat foods (i.e., palatable vs. unhealthy) depended on primed interpretation foci (i.e., restaurant vs. health). How-

ever, in contrast to these findings, Huijding, de Jong, Wiers, and Verkooijen (2005) did not find any differences in implicit evaluations of smoking as a function of whether evaluations were assessed in a smoking or a nonsmoking setting. Investigating effects of context cues on implicit ingroup favoritism, Zogmaister, Arcuri, Castelli, and Smith (2008) found that loyalty primes enhanced ingroup favoritism, whereas equality primes decreased ingroup favoritism. Along the same lines, Castelli and colleagues (2008) reported that ingroup members who showed ingroup bias were evaluated more favorably on an implicit measure but less favorably on an explicit measure.

Even though the reviewed findings suggest that implicit measures are highly variable across contexts, a recent study by Gschwendner, Hofmann, and Schmitt (2008) provided evidence for relatively high stability of implicit measures when the context is specified and kept constant. In their study, measures of implicit anxiety and implicit prejudice showed higher levels of stability over a period of 2 weeks when the procedure included construct-relevant backgrounds than when the relevant target stimuli were presented by themselves.

Categorization

Further evidence for the context-sensitivity of implicit measures is implied by research on category salience. For instance, Kühnen and colleagues (2001) found that increasing the salience of the categories East German and West German increased implicit ingroup bias in West German participants but decreased implicit ingroup favoritism in East Germans. Similar findings were obtained by Smith, Dijksterhuis, and Chaiken (2008), who found higher levels of implicit prejudice against African Americans when they subliminally primed white participants with white faces. Along the same lines, Steele and Ambady (2006) showed that female participants displayed a stronger implicit preference for arts over math when the salience of gender categories was high than when it was low. Investigating the flexibility of ingroup-related evaluations in participants with dual national identity, Bohner, Siebler, González, Haye, and Schmidt (2008) found that identity priming influenced men's, but not women's, implicit ingroup evaluations. Manipulating the relative salience of an intergroup context, Pratto and Shih (2000) found enhanced levels of implicit ingroup bias for participants high, but not for those low, in social dominance orientation (see Pratto, Sidanius, Stallworth, & Malle, 1994). Examining

the effects of categorization, Mitchell and colleagues (2003) found that implicit evaluations of the same familiar individual (e.g., Michael Jordan) depended on whether this individual was categorized in terms of race or occupation.

Category Interpretation

Even though these results suggest a powerful role of momentarily salient categories on implicit evaluation, a number of studies have shown that the particular impact of salient categories also depends on the momentary interpretation of these categories. For instance, Foroni and Mayr (2005) demonstrated a significant reduction in the well-replicated implicit preference for flowers over insects when participants were asked to read a fictional postnuclear war scenario in which all flowers were contaminated and insects were the only harmless food available. Similar effects were obtained by Govan and Williams (2004), who showed a reversal of participants' implicit preference for flowers over insects when the particular stimuli used in the task (e.g., butterfly, skunkweed) suggested a reversed evaluation of the two categories (i.e., flowers as negative and insects as positive). Applying similar considerations to racial prejudice, Richeson and Nussbaum (2004) found lower levels of implicit race bias among white participants when they read a message advocating a multicultural approach to reducing racial conflict than when they read a message advocating a color-blind approach. To the degree that a multicultural approach implies a favorable construal of ethnic categories whereas a color-blind approach aims at ignoring ethnic categories, these findings are consistent with the assumption that momentary construals of a given category influence implicit evaluations of that category.

Social Roles

Investigating the role of salient categories in an interactive context, Richeson and Ambady (2001, 2003) conducted a series of studies showing that superior or subordinate roles in dyadic interactions influence implicit prejudice. In one study, white participants showed higher levels of implicit racial bias when they anticipated being in a superior role versus an inferior role during an interaction with a black participant (Richeson & Ambady, 2003). Similar results were obtained for implicit gender bias when male participants anticipated superior versus inferior roles in a dyadic interaction with a female participant (Richeson & Ambady, 2001).

Expanding on these findings, McCall and Dasgupta (2007) showed that these effects are associated with increased levels of implicit self-stereotyping. Applying similar ideas to social roles in computer games, Uhlmann and Swanson (2004) demonstrated that playing a violent video game increased participants' associations between the self and aggressive traits.

Social Tuning

Going beyond anticipated social roles, a number of studies have investigated dynamic influences resulting from actual social interactions. Drawing on earlier research on social tuning (McCann & Higgins, 1992), these studies demonstrated that people's implicit evaluations tend to move closer to the presumed attitude of their interaction partner. In one study, Lowery, Hardin, and Sinclair (2001) found that white participants showed reduced levels of implicit race bias after they interacted with a black experimenter than when they interacted with a white experimenter. However, the generality of these findings was recently qualified by several follow-up studies showing that social tuning effects on implicit evaluations are limited to conditions under which participants have a motivation to affiliate with their interaction partner (Sinclair, Lowery, Hardin, & Colangelo, 2005) or an epistemic desire to acquire knowledge about the interaction partner (Lun, Sinclair, Whitchurch, & Glenn, 2007).

Motivational States

Further highlighting the significance of motivational processes, several studies have shown that implicit evaluations of goal-relevant objects vary as a function of goal pursuit (see also Ferguson & Porter, Chapter 17, this volume). In one of the first studies in this domain, Ferguson and Bargh (2004) showed that implicit evaluations of neutral words became more favorable when these words were relevant for the outcome in an achievement-related task. Along the same lines, Seibt, Häfner, and Deutsch (2007) found that implicit evaluations of food stimuli became more positive as a function of food deprivation. Investigating the effects of nicotine deprivation in smokers, Sherman, Rose, Koch, Presson, and Chassin (2003) obtained more favorable implicit evaluations of smoking-related stimuli in heavy smokers, whereas light smokers showed more favorable implicit evaluations when they had just smoked a cigarette than when they were nicotine deprived (see also Payne, McCler-

non, & Dobbins, 2007; Waters et al., 2007). Investigating similar influences on implicit alcohol evaluations in heavy drinkers, Schoenmakers, Wiers, and Field (2008) found no differences as a function of whether participants received a low dose of alcohol or a placebo drink, even though correlations between implicit alcohol evaluations and a measure of attentional bias to alcohol stimuli increased in the alcohol condition compared with the placebo condition.

Emotional States

A related set of studies have investigated the impact of affective or emotional states on implicit measures. For instance, Gamar, Segal, Sagrati, and Kennedy (2001) found that recently recovered depressed participants showed less favorable implicit self-evaluations following an induction of sad mood compared with control conditions. Using a longitudinal design with multiple measurements, DeHart and Pelham (2007) showed a strong relation between negative life events and implicit self-esteem for participants with low explicit self-esteem and low self-concept clarity. Studying emotional effects on intergroup attitudes, DeSteno and colleagues (2004) showed that anger, but not sadness, enhanced negative implicit evaluations of a meaningless outgroup. Investigating the effects of personal threat, Frantz, Cuddy, Burnett, Ray, and Hart (2004) obtained higher scores of implicit prejudice in an Implicit Association Test (Greenwald et al., 1998) when the task was introduced as a diagnostic measure of racism versus a measure of cultural stereotypes. Similar effects are reported by Rudman, Dohn, and Fairchild (2007), who found higher levels of implicit prejudice under conditions of personal threat, and by Gonsalkorale, Carlisle, and von Hippel (2007), who showed enhanced levels of implicit stereotyping in response to collective threat by the stereotyped group. Exploring the potential interplay between emotion and motivation, Birch and colleagues (2008) found that enhancement-motivated, but not coping-motivated, drinkers showed more favorable implicit alcohol associations after positive compared with negative mood induction.

Determinants of Contextualization

Even though the organization of our review may suggest that formation, change, and contextualization are independent, a recent study by Rydell and Gawronski (2009) provides evidence for systematic relations among the three. Using an impres-

sion formation paradigm with verbal statements as evaluative information and background colors as contextual cues, they showed that newly formed implicit evaluations generalized across different contexts when information about the attitude object was homogeneous. However, when prior information about the attitude object was subsequently challenged by evaluatively incongruent information, implicit evaluations became context-sensitive, such that they reflected the contingency between the valence of prior information and the context in which this information was acquired. Moreover, when the available information about the attitude object was heterogeneous across different contexts, novel contexts elicited implicit evaluations that reflected the valence of the initial experiences with the attitude object, indicating a superiority of earlier compared with later acquired information.

These results provide an integration of the notions of formation, change, and contextualization by specifying how each is related to the other two. Specifically, Rydell and Gawronski's (2009) findings show that initially formed associations tend to be context-independent, at least as long as the available information is homogeneous. If, however, the validity of these associations is later challenged by novel information, this information does not erase the old associations from memory. Instead, the resulting changes in implicit evaluations are often context-dependent in that they are limited to the particular context in which the novel information had been learned. The result is a contextualized activation of early versus later formed associations, which depends on the contingency between context cues and type of information during the formation of old and new associations.

Summary

Deviating from the notion of enduring effects in research on formation and change, there is strong evidence for context effects on the activation of associations assessed by indirect procedures. Such context effects pose a challenge to models that limit the possibility of contextual variations to self-report measures (e.g., Wilson et al., 2000). Moreover, models that explicitly address context effects on implicit measures differ considerably in their proposed explanations for these effects, with some attributing context effects to the impact of extrapersonal associations on particular kinds of measurement procedures (e.g., Fazio, 2007) and others explaining the same effects with the dynam-

ic nature of associative processes (e.g., Gawronski & Bodenhausen, 2006a). Notwithstanding these differences, several theories share the assumption that different categorizations of the same stimulus can influence what type of associations get activated in response to that stimulus (e.g., Fazio, 2007; Gawronski & Bodenhausen, 2006a), which accounts for at least a subset of the reviewed findings. In our view, the most important task for future research is to go beyond mere demonstrations of context effects and to investigate principles of contextualization versus generalization, ideally by integrating the available evidence on formation and change (e.g., Rydell & Gawronski, 2009).

Method-Related Effects

A common assumption in the literature on formation, change, and context effects is that experimentally induced changes in measurement scores reflect meaningful variations in the underlying associations. However, it is important to note that implicit measures do not provide a direct reflection of these associations. Instead, every procedure is based on task-specific mechanisms that mediate between the to-be-assessed associations and participants' performance in the task (Gawronski, Deutsch, LeBel, & Peters, 2008). Thus, it is possible that some experimentally induced effects are due to variations in the task-specific mechanism rather than the underlying associations. A number of studies support this concern.

Strategic Influences

A first set of studies that can be subsumed under the category of method-related effects tested the effectiveness of faking instructions on implicit measures. Even though earlier studies did not find any evidence for variations in measurement scores as a function of faking instructions (e.g., Banse, Seise, & Zerbes, 2001; Kim, 2003), more recent research showed small but significant influences for Greenwald and colleagues' (1998) Implicit Association Test (e.g., Czellar, 2006; De Houwer, Beckers, & Moors, 2007; Fiedler & Blümke, 2005; Lowery et al., 2001; Steffens, 2004; Verschuere, Prati, & De Houwer, 2009) and Fazio and colleagues' (1995) affective priming task (e.g., Degner, 2009; Klauer & Teige-Mocigemba, 2007; Teige-Mocigemba & Klauer, 2008). Needless to say, these variations in measurement scores do not necessarily reflect variations in the underlying associations but rather variations that are related to the mechanisms underlying a given measurement procedure.

Impaired Control

Further evidence for task-related variations in measurement scores comes from research using the Quad model (Conrey, Sherman, Gawronski, Hugenberg, & Groom, 2005). The Quad model is a multinomial model that allows researchers to quantify the relative contributions of four distinct processes that all contribute to a participant's performance on an indirect procedure (see also Sherman, Klauer, & Allen, Chapter 9, this volume). Aside from automatic associations, the most important of these processes is participants' success at overcoming the response tendencies resulting from automatic associations. Analyzing existing and new data sets with the Quad model, Sherman and colleagues (2008) found that some experimentally induced effects on implicit measurement scores are indeed due to variations in automatic associations, whereas others are due to variations in overcoming bias. For instance, Bartholow, Dickter, and Sestir (2006) found increased scores of implicit race bias as a result of alcohol consumption, which, according to Sherman and colleagues' reanalysis, are exclusively driven by participants' impaired ability to overcome their association-related responses. Using an adaptation of Jacoby's (1991) process-dissociation procedure, similar effects of impaired executive control are reported by Govorun and Payne (2006) for ego-depletion (Muraven & Baumeister, 2000) and by Lambert and colleagues (2003) for enhanced arousal resulting from anticipated public contexts.

These findings have important implications for at least some of the reviewed findings. For instance, to the degree that personal threat impairs executive function (e.g., via increased levels of arousal), it seems possible that increased scores of implicit prejudice (e.g., Frantz et al., 2004; Rudman et al., 2007), implicit stereotyping (Gonsalkorale et al., 2007), and even implicit self-esteem (Rudman et al., 2007) resulting from personal threat are due to participants' reduced ability to control association-related response tendencies rather than genuine variations in the underlying associations. Given this alternative interpretation, researchers should be cautious in drawing potentially premature conclusions from threat-related effects on implicit measures.

Procedural Variations

Another important issue in this context is the fact that not all procedures are based on the same task-specific mechanism. Thus, a given effect obtained

with one procedure may not necessarily generalize to another procedure that is based on a different mechanism. Needless to say, such cases indicate that the obtained effect is most likely driven by task-specific mechanisms rather than by the underlying associations, which should be equal for two otherwise equivalent procedures. However, determining the correct interpretation for a given effect seems much more difficult when two procedures produce opposite effects for the same manipulation. To our knowledge, at least two studies have demonstrated such antagonistic effects. One example is a series of studies by Gawronski and Bodenhausen (2005), who showed that generating a high (versus low) number of counterstereotypical exemplars decreased scores of implicit stereotyping on procedures that are based on stimulus-stimulus compatibility but increased implicit stereotyping scores on procedures that are based stimulus-response compatibility (see De Houwer, 2003). The latter finding resembles earlier evidence for ease-of-retrieval effects on social judgments (Schwarz et al., 1991), whereas the former is in line with spreading activation models of associative activation, suggesting that the activation level of associations in memory should increase as a function of increasing stimulation. A second example is a series of studies by Deutsch and Gawronski (2009), who found that two sequentially presented prime stimuli produced contrast effects in Fazio and colleagues' (1995) affective priming task (see also Gawronski, Deutsch, & Seidel, 2005), but additive effects in an otherwise identical version of Payne, Cheng, Govorun, and Stewart's (2005) affect misattribution procedure. Taken together, these results indicate that researchers should be cautious in interpreting experimentally induced differences in measurement scores as direct reflections of variations in the underlying associations, given that differences in measurement scores can also be driven by effects on task-specific mediators (for a more detailed discussion, see Gawronski, Deutsch, LeBel, & Peters, 2008).

SUMMARY

The main goal of the present chapter was to review theoretical models and the empirical evidence regarding the formation, change, and contextualization of the associations assessed by indirect procedures. The currently available data suggest a wide range of factors that may contribute to the formation of mental associations. The same is true for the factors producing changes in preex-

isting associations. In addition to these findings, an accumulating body of research has investigated the context dependency of implicit measures. However, recent studies showing method-related effects suggest that researchers should be cautious in quickly interpreting experimentally induced variations in measurement scores as direct evidence for variations in the underlying associations, and this concern applies equally to research on formation, change, and contextualization. The majority of construct-related findings are well explained by current models of attitudes, which to a large extent are applicable to nonevaluative representations as well. Nevertheless, there are some considerable asymmetries in the power of the reviewed models in integrating the available evidence. A critical challenge for all of these theories is to move from developing post-hoc explanations for existing findings to generating new hypotheses that could help to establish each theory's predictive power. In addition, it would be useful to supplement future studies on formation, change, and contextualization with behavioral measures. A common assumption in past and current research is that observed changes in the assessed constructs will lead to corresponding changes in behavior (see Perugini et al., Chapter 14, this volume). Even though this assumption seems quite plausible, it is not trivial and has not been tested empirically. Thus, to the degree that previously obtained correlations between implicit measures and overt behavior are driven by a common third variable, experimentally induced variations in implicit measures may not necessarily be related to corresponding changes in behavior if the common third variable is unaffected. Given the increasing use of indirect measurement procedures in applied contexts (see Nosek, Graham, & Hawkins, Chapter 29, Perkins & Forehand, Chapter 28, Snowden & Gray, Chapter 27, Teachman, Cody, & Clerkin, Chapter 26, and Wiers et al., Chapter 25, this volume), we propose that this question should be regarded as one of the next major steps in research on the formation, change, and contextualization of the associations assessed by indirect procedures.

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NOTE

1. Following De Houwer (2006b), we use the terms *direct* and *indirect* to describe the nature of measurement procedures and the terms *explicit* and *implicit* to refer to the outcomes or measurement scores obtained by these procedures. The term *measure* is used to describe measurement scores, whereas measurement procedures are always identified as such. Please note that the terms *explicit* and *implicit* are simply used for illustrative purposes without any empirical claims about the automatic/unconscious or controlled/conscious nature of the assessed constructs (see Moors, Spruyt, & De Houwer, Chapter 2, this volume).

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