

Implicit Measures of Attitudes

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Asking people to self-report their thoughts and feelings is a simple and straightforward method for measuring attitudes. For example, if you tell me that you think highly of a new colleague, Susan, I now have useful and important information regarding your attitude toward Susan. However, researchers have long known that such self-report measures are imperfect indicators of attitudes for at least three reasons. First, self-report measures are subject to social desirability and self-presentational concerns (Paulhus, 1991). Knowing that I am friendly with Susan is likely to influence what you are willing to say about her. Second, self-report measures are notoriously sensitive to contextual factors that are unrelated to the attitude itself (Schwarz, 1999). For example, asking you to report your attitude toward Susan immediately after she declined your request to serve on a committee is likely to lead to a different attitude than you would report if she had agreed. Finally, reliance on self-report measures erroneously assumes that one has introspective access to their attitudes (Nisbett & Wilson, 1977). For example, you might be unaware that your attitude toward Susan is influenced by her gender or other group memberships.

To minimize the problems with self-report, researchers have developed a wide variety of measures that assess thoughts, feelings, and behaviors in a way that does not require introspection. Such *implicit measures* of attitudes typically do not alert the respondent to what is being measured, or do not allow the respondent control over their response even if they do know what is being measured. In addition to providing a richer assessment of evaluations, the inclusion

of implicit measures in attitude research can be important for predicting behaviors (e.g., Greenwald, Poehlman, Uhlmann, & Banaji, 2009).

Chapter Overview

The purpose of the current chapter is to describe a variety of implicit measures of attitudes. In the next section we provide summary information regarding the general method and important methodological features of eight such measures (and their variations). A common source of misunderstanding is that some researchers use the terms *implicit* and *explicit* to refer to features of the attitude that is being measured (i.e., a measure of implicit attitudes; e.g., Greenwald & Banaji, 1995) and others use the terms *implicit* and *explicit* to refer to features of the measurement (i.e., an implicit measure of attitudes; e.g., Petty, Fazio, & Briñol, 2009). In the current chapter, we take the latter approach (see also Chapter 1). We consider a measure to be implicit if the measurement outcome is thought to rely on processes that are some combination of uncontrolled, unintentional, autonomous, unconscious, efficient, or fast (De Houwer & Moors, in press). Further, many of the measures that we describe can be used to assess other constructs (e.g., identity, stereotypes, self-esteem); however, in this chapter we focus singularly on the measurement of attitude -- a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor (Eagly & Chaiken, 1998).

The descriptions that follow provide a basic introduction to each implicit measure of attitudes. As such, the interested reader is directed to previous reviews of implicit attitude measures that have approached this issue in complementary ways (De Houwer, 2003a; De Houwer, 2009; Fazio & Olson, 2003; Gawronski & Payne, 2010; Nosek, Hawkins, & Frazier, 2011; Uhlmann, Leavitt, Menges, Koopman, Howe, & Johnson, 2012). For each measure, we

describe: (a) a general overview of the procedure, (b) the benefits and drawbacks of its use, and (c) its relation to other measures and to behavior.

Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998) and its variants

Overview and procedure. The IAT is by far the most widely-used implicit measure of attitudes, accounting for more than 40% of total citations through the year 2010 (Nosek, Hawkins, & Frazier, 2011; see also Perugini et al.'s chapter). The IAT has generated (and, arguably, withstood) a level of criticism virtually unheard of in research psychology and – partially as a function of that criticism – has seen periodic improvements (see Lane, Banaji, Nosek, & Greenwald, 2007, for a review). The IAT is a response-competition task based on the assumption that closely-associated concepts facilitate response to one another. The IAT measures the strength of associations between two concept categories (e.g., Black people and White people) and two evaluative attributes (e.g., good and bad). The stimuli used to represent the concept categories and evaluative attributes can be words (e.g., Black, African American, good, bad) or pictures (e.g., pictures of positive or negative objects). A typical IAT consists of 7 blocks of trials (Nosek, Greenwald, & Banaji, 2005). The first two blocks of the IAT are practice blocks in which the participant categorizes words that appear in the center of the screen using two different keys on the keyboard (e.g., “E” and “I”) that correspond to category labels that appear on the left and right side of the screen, respectively. In the first block, the participant sorts words into the categories “good” and “bad”; in the second block the participant sorts words into the categories “Black people” and “White people”. The third and fourth blocks are critical blocks in which one response key is used to categorize good words or Black people and another is used to categorize bad words or White people. In the fifth block the participant practices categorizing pictures of Black and White people using the opposite keys than they used previously (i.e., if the

category Black people was on the left and White people in the right, the category labels and corresponding response keys switch). The number of trials in this block is typically twice what was used in the first practice blocks in order to reduce potential learning effects. The sixth and seventh blocks are critical blocks with the opposite pairing of the third and fourth blocks; in this case, one response key would now be used to categorize bad words or Black people and another to categorize good words or White people). The underlying idea of the IAT is that one should be faster to categorize words when closely related items share the same response key. A more negative association with Black people than White people is inferred if people are able to complete the task more quickly when Black people + bad and White people + good share response keys relative to when Black people + good and White people + bad share the same response key. Greenwald, Nosek, and Banaji (2003) provide more specific information about scoring the IAT.

Relation to behavior and other measures. IAT scores have been shown to predict a wide-variety of important, real-world outcomes such as: whites' behavior in interracial interactions (Dovidio, Kawakami, & Gaertner, 2002), race-based disparities in physicians treatment of patients (Green et al., 2007), the longevity of romantic relationships (LeBel & Campbell, 2009), suicidal behavior (Nock et al., 2010), voting behavior (Frieze, Smith, Plischke, Bluemke, & Nosek, 2012), consumer behavior (Maison, Greenwald, & Bruin, 2004), and consumption behavior (Frieze, Hofmann, & Wanke, 2008). Greenwald et al. (2009) provide a meta-analysis of 184 studies using the IAT to predict behavior, concluding that the average correlation is $r = .27$, and that the IAT is particularly valuable in predicting behavior in socially sensitive domains (cf., Oswald, Mitchell, Blanton, Jaccard, & Tetlock, 2013). The relationship between the IAT and explicit measures has proved to be highly variable. A review of 57 attitude objects indicated that

the average correlation was .36, but this ranged from no significant relationship to a high of $r = .70$ based on the attitude object, with the strongest relationships found for political attitudes (Nosek, 2005). A number of other moderators of the relationship between the IAT and explicit attitudes have been discovered (for additional reviews, see Hofmann, Gawronski, Gschwendner, Le, & Schmitt, 2005, and Hofmann, Gschwendner, Nosek, & Schmitt, 2005). In short, explicit attitudes are more related to the IAT when self-presentational concerns are low (Hofmann, Gschwendner et al., 2005; Nosek, 2005), when the attitude is of high importance (Karpinski, Steinman, & Hilton, 2005) or strongly-held (Nosek, 2005), and when mood is positive (Huntsinger & Smith, 2009) or marked by anger (Huntsinger, 2013). Additionally, the relationship is stronger to the extent that explicit measures are related to spontaneous, gut-level, affective responses (Gawronski & LeBel, 2008; Hofmann, Gawronski et al, 2005; Hofmann, Gschwendner et al., 2005; Ranganath, Smith, & Nosek, 2008; Smith & Nosek, 2011) . See also the chapter by Schmitt et al. on the convergence of different measures in this volume.

Benefits and drawbacks. The IAT has excellent psychometric properties including high reliability (ranging from .70-.90; Gawronski & De Houwer, in press), good convergent and discriminant validity (Gawronski, 2002) and high predictive validity (Greenwald et al., 2009)¹.

A number of criticisms have been leveled against the IAT, each sparking response from IAT proponents. These concerns (see Fiedler, Messner, & Bluemke, 2006, for an overview) include that participants can be instructed to fake their scores on the IAT (e.g., De Houwer, Beckers, & Moors, 2007; Fiedler & Bluemke, 2005; Steffans, 2004) and that the metric on which the IAT is scored may be problematic (Blanton & Jaccard, 2006). In addition, some researchers

¹ Although we refer to “the IAT”, individual IATs should be evaluated separately based on the specific procedures used (e.g., amount of time between trial, format and font options, stimuli choices, and whether the IAT assesses attitudes, stereotypes, beliefs, self-esteem, or something else. Numbers provided here are based on meta-analysis.

made changes to the measure in an attempt to tackle concerns they had; we describe those measures next.

Personalized Implicit Association Test (PIAT; Olson & Fazio, 2004)

The Personalized IAT was designed to address concerns that the standard version of the IAT may be “contaminated” by cultural knowledge (i.e., associations in mind that are “extrapersonal”) rather than assessing associations that are truly evaluative in nature. For example, Olson and Fazio (2004) argue that, in a traditional race IAT, participants in the United States may respond more quickly to the White people + good/Black people + bad pairing than to the reverse pairing because they are aware of their culture’s long history of discrimination, and not necessarily because of their personal associations. While other researchers have argued that dividing mental associations in this way may not be theoretically meaningful (Gawronski, Peters, & LeBel, 2008; Nosek & Hansen, 2008; Uhlmann, Poehlman, & Nosek, 2012), the PIAT was developed to eliminate this perceived confound.

The PIAT procedure is identical to that of the standard IAT, with two key differences. First, the evaluative category labels (“good” and “bad”) are changed to “I like” and “I dislike”. Also, no error feedback is given (though some recent instantiations of the PIAT have reintroduced error feedback such as Han, Olson, & Fazio, 2006 and Olson, Crawford, & Devlin, 2009). This measure has gained a fairly strong foothold in the literature; the original paper has been cited more than 200 times at the time of writing. The PIAT has been used to measure attitudes toward alcohol (Houben & Wiers, 2007), consumer goods (Han, Czeisler, Olson, & Fazio, 2010; Smith, De Houwer, & Nosek, 2013), stigmatized groups (Goff, Eberhardt, Williams, & Jackson, 2008; Olson et al, 2009), and smoking (De Houwer, Custer, & De Clercq,

2006). Although a formal review has yet to be published, in general the PIAT shows psychometric properties comparable to those of the classical IAT (e.g., Smith et al., 2013). *Single-Block Implicit Association Test (SB-IAT; Teige-Mocigemba, Klauer, & Rothermund, 2008) and Recoding Free Implicit Association Test (IAT-RF; Rothermund, Teige-Mocigemba, Gast, & Wentura, 2009).*

Two related measures have been designed to address concerns that the blocked structure of the IAT can lead participants to adopt recoding strategies to simplifying the task (e.g., De Houwer, Geldof, & De Bruycker, 2005; Rothermund, Wentura, & De Houwer, 2005; Wentura & Rothermund, 2007). For example, a participant might adopt the strategy of combining the White people and good categories into a single mental category of “Things I like” and the Black people and bad categories into “Things I don’t like”. An artificial inflation of IAT score results when participants find it more difficult to simplify the reverse pairings in a similar way. In response to these concerns, researchers developed the IAT-Recoding Free and the Single-Block IAT. In the IAT-RF, the category labels (White people, Black people) switch sides randomly between trials, preventing an idiosyncratic method of recoding the task. On each trial of the IAT-RF, the new category pairings are presented for 1000 ms and then a fixation cross is presented for 500 ms where the stimuli will appear to reorient the participant’s attention. In the IAT-RF, as with the IAT, participants first practice good and bad words, and then practice sorting pictures of Black people and White people before combining these two types of trials into a “critical block”. A preference for White people compared to Black people is inferred if people are able to complete the task more quickly on the trials in which Black people + bad and White people + good share response keys relative to the trials in which Black people + good and White people + bad share the same response key. The IAT-RF typically has reliability ranging from .40-.70 (Gawronski &

De Houwer, in press). To date, there is only one use of the IAT-RF that includes a self-report measure and behavior. That study showed that an alcohol IAT-RF was not related to heavy drinkers' explicit attitudes or to problematic alcohol behavior, but that the IAT-RF did predict self-reported alcohol use (Houben, Rothermund, & Wiers, 2009).

A similar measure that was also designed to mitigate potential problems with participant recoding strategies is the Single Block IAT (S-BIAT). A participant faced with an S-BIAT would see the congruent (White people + good/Black people + bad) and incongruent (White people + bad, Black people + good) pairings on the same screen, one on the top, the other on the bottom. The pairings are separated by a dotted line and participants are instructed to sort target words using the pairings at the top of the screen when a stimulus is presented above the dotted line, and to use the pairings at the bottom of the screen when a stimulus is presented below the dotted line. A greater preference for Black people compared to White people is inferred if people are able to complete the task more quickly on the trials in which Black people + good and White people + bad share response keys relative to the trials in which Black people + bad and White people + good share the same response key, regardless of whether the pairing was at the top or bottom of the screen. The S-BIAT typically has reliability ranging from .60-.90 (Gawronski & De Houwer, in press). In the one investigation of the relationship between the S-BIAT and outcome measures, S-BIAT scores showed a moderate correlation ($r = .43$) with explicit political attitudes and predicted voting intentions; predictive ability of the S-BIAT disappeared when entered into a simultaneous regression which included explicit attitudes (Teige-Mocigemba et al., 2008).

The Single Category-Implicit Association Test (SC-IAT; Karpinski & Steinman, 2006) and Single Target-Implicit Association Test (ST-IAT; Bluemke & Friese, 2008)

The Single Category and Single Target IATs are nearly identical measures and, in practice, the names are used interchangeably. The sole difference between the SC-IAT and the ST-IAT is that the original version of the SC-IAT required a response deadline of 1500 or 2000ms in an attempt to induce a sense of speed to the task, whereas the ST-IAT does not. To avoid unnecessary confusion, we will refer to the measure as the ST-IAT.

The ST-IAT improves upon the IAT by allowing for the measurement of associations between evaluations and one single category (e.g., Black people + good and Black people + bad) rather than requiring two categories. The ST-IAT procedure is identical to that of the IAT after dropping one of the four categories (White people, in the current example). Participants sort Black people + good with one key, while using the other key to sort words into the category “bad”. They then complete a block during which Black people are paired with bad, and the other key is used for the category “good”. A more negative association with Black people is inferred if people are able to complete the task more quickly on the trials in which Black people + bad share a response key relative to the trials in which Black people + good share a response key. For more information about scoring, see Karpinski and Steinman (2006).

The ST-IAT is easy to modify, measures a single attitude object with good reliability ($r = .70-.90$; Bar-Anan & Nosek, in press; Gawronski & De Houwer, in press), making it a highly recommendable implicit measure. On the downside, the ST-IAT is easier to fake than the traditional IAT (Stieger, Göritz, Hergovich, & Voracek, 2011), this is possibly caused by its simpler structure that is easier for participants to figure out and employ successful faking strategies. The ST-IAT has successfully predicted behavior in several different contexts. For example, more positive attitudes on a nuclear power ST-IAT predicted support for increasing governmental reliance on nuclear power and less reluctance to have a nuclear plant placed near

their home (Truelove, Greenberg, & Powers, in press) and a political party ST-IAT predicted voting in the 2002 German Parliamentary elections (Friese, Bluemke, & Wanke, 2007).

Brief Implicit Association Test (BIAT; Sriram & Greenwald, 2009)

General Procedure. Although its name implies that it is a shorter version of the IAT, the BIAT differs structurally from the original IAT in important ways, so we chose not to include it in the section on IAT variations. It is also important to know that the BIAT does not necessarily take less time for a participant to complete. Like other versions of the IAT, the BIAT is a response-competition measure. A participant faced with a BIAT is asked to press one key for any stimulus that fits into either of two focal categories (e.g., Black people and good) and a second key for any other stimuli (e.g., White people and bad). In the other block, the participant would press one key for any stimulus that fits into the category of White people and good, and a second key for any other stimuli (e.g., Black people and bad). The original authors recommend preceding these blocks with a training phase in which the participant practices how the task works, but using different categories than during the test itself; for example, participants can use one key to sort the focal categories of birds and curved objects and another key to sort the non-focal categories of mammals and angled objects (see Sriram & Greenwald, 2009). An implicit preference for Black people is inferred if participants are able to complete the task more quickly on trials in which Black people + good share a response key relative to the trials in which White people + good share a response key. For more information about scoring, see Sriram and Greenwald (2009). Note also that the BIAT has shown to have better psychometric properties when the focal evaluative attribute is “good” than when it is “bad” (Sriram & Greenwald, 2009), although the reason for this is not yet well-understood.

Relation to behavior and other measures. In a comparison of seven different implicit measures, the BIAT showed the strongest relationship with explicit measures and with other implicit measures (Bar-Anan & Nosek, in press). To date, the BIAT has only been used to predict voting behavior; a political party BIAT predicted voting intention in the 2008 Serbian Parliamentary elections (Pavlović & Žeželj, 2013) and implicit race bias on the BIAT predicted voting behavior in the 2008 U.S. Presidential race between John McCain and Barack Obama (Greenwald, Smith, Sriram, Bar-Anan, & Nosek, 2009).

Benefits and drawbacks. One of the strongest benefits of the BIAT is its high reliability (ranging from .55 to .95; Bar-Anan & Nosek, in press; Gawronski & De Houwer, in press). Additionally, the BIAT can be used to assess comparative associations with “good” between a (theoretically) infinite number of attitude objects. In order to add a third category (e.g., Asian people), a block would be added in which participants pressed the “K” key for the focal categories of Asian people and good, and the “D” key for the non-focal categories of Black people, White people, and bad. In addition, Asian people would be added to the non-focal group when Black people and White people were focal. The number of categories measured is only limited by the time and energy (and patience) of the participant. This is a particular advantage of the BIAT which has been underutilized to date.

One drawback of the BIAT is the impact of order effects. At the level of the experiment, it is important to counterbalance the order of these blocks to ameliorate the effects of block order. Order effects can be reduced for individual scores by cutting each of the two critical blocks in half and randomizing the resulting four blocks (for an example see Bar-Anan & Nosek, in press). In addition, the BIAT is similar enough to the IAT that it suffers from similar task-

specific influences such as potential recoding processes, salience asymmetries, and effects of particular stimuli (Rothermund & Wentura, 2010).

Evaluative Priming Task (EP task; Fazio, Sanbonmatsu, Powell, & Kardes, 1986)

Overview and procedure. The EP task was instrumental in opening new frontiers in attitude theory and measurement. It is the second most-commonly used measure in psychological research, accounting for nearly 20% of all citations using an implicit measure through 2010 (Nosek, Hawkins, & Frazier, 2011). The EP task is based on the assumption that the activation of one concept automatically activates (or “primes”) related concepts. For example, the activation of the concept “doctor” might automatically activate the concept “nurse”. The assumption of the EP task is that, to the extent that an attitude is strong, the activation of one concept automatically activates an evaluation. Responding to a “target” stimulus should be faster to the extent that the prime and evaluative target are associated. A participant faced with a typical EP task would be presented with a series of trials in which they would briefly see a picture of a Black or White individual (the prime; e.g., 200 ms) followed by a blank screen (e.g., 50 ms), and then a positive or negative word (the target). The participant’s objective is to press one key (e.g., “E”) if the target is a positive word, and another key (e.g., “I”) if the target is a negative word. A stronger association between Black people and bad relative to White people and bad would be inferred if pictures of Black people facilitate (i.e., speed up) responding to negative words to a greater extent than pictures of White people facilitate responding to negative words. Although a number of variants exist, it is recommended to instantiate the measure by presenting three blocks of 60 trials each (Fazio, Jackson, Dunton, & Williams, 1995). See Wittenbrink (2007) for more specific information about scoring the EP task.

Relation to behavior and other measures. The literature on the EP task is too vast to review here, so we point the interested reader to the most recent review paper (Herring et al., 2013). The EP task has been shown to predict behavior in important domains; less positive attitudes toward African-Americans on the part of white participants led to a more negative interracial interaction as rated by their African-American experimenter (Fazio et al., 1995). Similarly, for adolescents, more negative attitudes toward Turks were related to more discriminatory behavior during a ball-tossing task (Degner, Wentura, Gniewosz, & Noack, 2007). In addition, an EP task measuring attitudes toward the television show Big Brother predicted minutes spent watching that show, although the predictive ability of this measure declined to non-significance when controlling for explicit attitudes (Frings & Wentura, 2003). A recent review of uses of an EP task to measure attitudes found that the measure related to explicit self-reports at $r = .13$, and behavior at $r = .25$ (Cameron, Brown-Iannuzzi, & Payne, 2012).

Benefits and drawbacks. The mechanisms and outcomes of the EP task have been studied more than almost any other measure, providing researchers with a great deal of guidance in its use (e.g., De Houwer, Teige-Mocigemba, Spruyt, & Moors, 2009; Herring et al., 2013; Klauer & Musch, 2003). Another major benefit of the EP task as an implicit measure of attitudes is that one can separately calculate associations between different primes and target categories. For example, the inclusion of a neutral baseline condition in a race EP task allows one to separately estimate the association between Black people and good, Black people and bad, White people and good, and White people and bad. However, like the IAT and SC-IAT, it may be possible for a motivated participant to deliberately control the outcome of the EP task (Teige-Mocigemba & Klauer, 2008). The primary drawback of the EP task is a big one – its reliability is notoriously

low, rarely exceeding .50 and typically even lower than that (Gawronski & De Houwer, in press).

Go/No-Go Association Task (GNAT; Nosek & Banaji, 2001)

General Procedure. The GNAT (Nosek & Banaji, 2001) assesses automatic associations between a single concept (e.g., Black people) and two evaluative categories (e.g., good, bad). A participant faced with the GNAT is instructed to hit a key (e.g., the space bar) when an item belongs to one of two labeled categories presented at the top of the computer screen (i.e., “Go”) and to do nothing when an item belongs to any other category (i.e., “No-go”). For example, in a first block, a participant might be asked to “Go” for images of Black people and good words (and do nothing for images of White people and bad words), and then in a second block they would be required to “Go” for images of Black people and bad words (and do nothing for images of White people and good words). The GNAT is scored using either signal detection (d -prime) or response latencies. If a signal detection approach is utilized (see Nosek & Banaji, 2001 for details on this scoring procedure), then a response window of 500 to 850 ms is advised in order to induce an appropriate level of errors necessary for scoring. If latencies are used for scoring, a response window is not necessary, although the authors do recommend using a latency deadline of 2000 ms for target stimuli (and 1000 ms for distractor stimuli) to encourage automatic responding. A red “X” is presented if participants respond incorrectly, either by mistakenly hitting the space bar during a distractor trial or by not hitting the space bar quickly enough during a target trial. When using latencies, the task is scored by calculating the average of the responses to each of the four types of trials. These averages can be compared to one another directly, or can be turned into a single indicator of evaluation toward Black people by subtracting the average latency during

trials when the category of “Black people” is paired with the category “good” from trials when Black people are paired with bad words.

The GNAT has not enjoyed widespread use, but has shown good flexibility in that it has been modified to measure attitudes toward genetically-modified food (Spence & Townsend, 2007), gender (Mitchell, Nosek, & Banaji, 2003), race (Sherman, Stroessner, Conrey, & Azam, 2005), and sexuality (Ranganath et al., 2008). Williams and Kaufmann (2012) provide an in-depth investigation of issues regarding GNAT design and resulting implications for reliability estimates and Vianello and Robusto (2010) for the benefits of applying a many-facet Rasch model to GNAT scoring.

Relation to behavior and other measures. The GNAT relates to explicit attitudes and to other implicit measures at approximately the same level as the IAT (both r s around .40; Bar-Anan & Nosek, in press). In terms of predicting behavior, a GNAT measuring implicit attitudes toward genetically-modified food predicted spontaneous valuation of a box of chocolates described as being genetically-modified (Spence & Townsend, 2007). In addition, increasingly negative attitudes toward Black people predicted less willingness to vote for Barack Obama in the 2009 Presidential election and less support for his health care plan, even when controlling for explicit prejudice (Knowles, Lowery, & Schaumberg, 2010).

Benefits and drawbacks. The GNAT has good psychometric properties (Williams & Kaufman, 2012) including acceptable reliability (ranging from .45 to .75; Bar-Anan & Nosek, in press; Gawronski & De Houwer, in press). As noted above, the GNAT can be scored using a signal detection approach which is unique among implicit measures and which may be considered a benefit. The GNAT has been used very little and, as such, relatively little is known about its operation.

The Extrinsic Affective Simon Task (EAST; De Houwer, 2003b)

General procedure. The EAST assesses automatic associations between a single concept (e.g., Black people) and two evaluations categories (e.g., good, bad). In the EAST, participants see good and bad adjectives in white font and attitude-relevant stimuli in colored font (e.g., green and blue). When words are in white font, participants are instructed to sort the words on the basis of their evaluative meaning (e.g., sort good words to the left using the “Q” key and bad words to the right using the “P” key). In this way, the two keys gain a consistent valence. When the words are in color, they are instructed to sort the words based on their color (e.g., sort blue words to the left using the “Q” key and green words to the right using the “P” key). Importantly, however, all of the words for one attitude object are presented in one color (e.g., gay people in blue) while all of the words for another attitude object are presented in another color (e.g., straight people in green). Thus, the shared key structure of the IAT is duplicated, but with a less obvious evaluative flavor, which may help to reduce demand characteristics in the participant. The EAST can be scored either using the percentage of errors committed or response latencies during each of the types of responses. Assessing errors is based on the assumption that an error response indicates difficulty with the task analogous to slowing down (i.e., less errors is related to a stronger mental association). In the case of errors, the percentage of trials is calculated on which a participant made an error, and this number is compared to percentages in the other trials. For example if a person makes more errors when the “Q” key is used to sort good words and words in blue (which all relate to Gay People) than they do when using the “P” key to sort bad words and words in blue that indicates a negative implicit evaluation of gay people. One can do the same thing using latencies by calculating the average latency of a participant in sorting each of the types of stimuli. As the original EAST did not perform well as a measure of interindividual differences,

the Identification-EAST (De Houwer & De Bruycker, 2007) was developed which used lower case and upper case words in the place of colors and which showed better psychometric properties. The EAST has been modified for use as a measure of attitudes toward alcohol (De Houwer, Crombez, Koster, & De Beul, 2004; de Jong, Wiers, van de Braak, & Huijding, 2007), back pain (Houben, Gijzen, Peterson, de John, & Vlaeyen, 2005) spiders (Huijding & de Jong, 2006), and stigmatized groups (Degner & Wentura, 2008). The EAST has also been modified to include the use of pictures rather than words (Huijding & de Jong, 2005).

Relation to behavior and other measures. Positive attitudes on an alcohol EAST predict increased alcohol use and problems with alcohol (de Jong et al., 2007).

Benefits and drawbacks. A drawback of the EAST is its relatively low reliability (De Houwer & De Bruycker, 2007; $r = .60-.70$; Gawronski & De Houwer, in press). The EAST has been used very little and, as such, relatively little is known about its strengths and weaknesses.

The Sorting Paired Features task (SPF; Bar-Anan et al., 2009)

General procedure. The SPF, which shares structural similarity with the S-BIAT, is an especially interesting variant of the IAT. Like the IAT, the SPF was designed based on the assumption that it is easier to respond quickly to paired concepts that are more strongly associated in the mind. However, in the SPF this pairing occurs both at the category level and the stimulus level. In other words, rather than sorting individual stimuli into two categories in the upper left and upper right corners of the screen – as in the IAT – in the SPF, the four category combinations appear simultaneously in the four corners of the screen. In this way both “congruent” and “incongruent” blocks are presented simultaneously. Specifically, pairs of stimuli are presented in the center of the screen, one from one of the two evaluative categories, and one from one of the two attitude objects (e.g., “tall people” and “good”). The task is to sort

these paired stimuli into one of the four corners of the computer screen (e.g., “tall people + good”, “tall people + bad”, “short people + good”, “short people + bad”) as quickly as possible, using four keys (e.g., “Q”, “P”, “C”, and “M”). If a mistake is made, a red “X” appears, and the participant must correct the mistake to continue. Latencies are recorded from the appearance of a stimulus pair until a correct response is made. Successful instantiations of the SPF have ranged from a low of 120 trials to a high of 216 trials (both in Bar-Anan et al, 2009), organized into between two and four blocks, with the positions of the paired categories either held constant or randomized across those blocks. Scores are calculated by first calculating the average latency of categorizing each of the four types of trials (e.g., “tall people + good”). Those scores are then used to calculate an implicit attitude toward tall people by subtracting trials in which the category “tall people” was paired with “bad” from when “tall people” was paired with “good”. Similarly, an implicit attitude toward short people is indexed by subtracting “short people” and “bad” from “short people” and “good”. From these two scores, one can calculate a relative preference by subtracting evaluations of short people from evaluations of tall people.

Relation to behavior and other measures. The SPF has not yet been used to predict behavior. It is only modestly related to other implicit measures and to explicit attitudes (Bar-Anan & Nosek, under review).

Benefits and drawbacks. A benefit of this measurement procedure is that it allows for both the calculation of an attitude toward a single attitude object and a relative preference. Additionally, it may ameliorate order effects and effects of task recoding. The SPF has been used rarely and, as such, relatively little is known about its operation.

The Affective Misattribution Procedure (AMP; Payne, Cheng, Govorun, & Stewart, 2005)

General procedure. The AMP is based on the idea that the valence of a viewed stimuli will automatically transfer to a subsequently-presented neutral stimuli. In particular, the AMP is composed of trials which consist of a prime (e.g., an image of a Black person presented for 75 ms), followed by a blank screen (e.g., 125 ms), then a Chinese pictograph (e.g., for 100 ms), and then a mask. The participant is instructed to ignore the prime and evaluate the pictograph; they press one key (e.g., “E”) if they find the pictograph “more pleasant than average” and another key (e.g., “I”) if they find the pictograph “less pleasant than average”. In one-third of the trials in the original AMP procedure, the pictograph is preceded by a neutral prime (i.e., a gray square); some subsequent instantiations have not included the neutral prime trials (Payne, Burkley, & Stokes, 2008). Unlike most implicit measures, the AMP is not scored by comparing response latencies. Instead, one calculates a proportion of the times a participant responds that a pictograph is “more pleasant than average” and “less pleasant than average” following each of the primes. For example, in an AMP with 36 trials, with 12 trials each of Black people, White people, and grey squares, it is possible to calculate the implicit positivity toward Black people (i.e., number of “pleasant” responses following pictures of Black people, divided by 12) and White people (i.e., number of “pleasant” responses following pictures of white people, divided by 12). Responses toward the grey squares can be used as an individual’s baseline of positive responding. The AMP has been used to measure attitudes toward political candidates (Payne et al., 2005), racial groups (Payne et al., 2005), alcohol (Payne, Govorun, & Arbuckle, 2008); consumer goods (Smith et al., 2013), moral behavior (Hofmann & Baumert, 2010), and smoking (Payne, McClernon, & Dobbins, 2007). Recently, De Houwer and Smith (2013) showed that instructing participants to focus on their gut-level affective responses while completing an AMP

increased effect sizes on the measure, suggesting an improvement to the commonly-used task instructions.

Relation to behavior and other measures. The AMP relates to self-report measures fairly well (average $r = .30$; Cameron et al., 2013). Its relationship to other implicit measures is slightly lower, perhaps owing to its uniqueness regarding procedural and scoring elements (Bar-Anan & Nosek, in press). The AMP predicts several different kinds of behaviors. For example, positivity toward alcohol is related to alcohol use (Payne et al., 2008); scores on an AMP measuring morality predicted emotional responses to a moral dilemmas and a fairness violation (Hofmann & Baumert, 2010); and race bias on the AMP predicted voting behavior in the 2008 U.S. Presidential race between John McCain and Barack Obama (Greenwald, Smith, Sriram, Bar-Anan, & Nosek, 2009; Pasek et al, 2009; Payne, Krosnick, Pasek, Lelkes, Akhtar, & Tompson, 2010).

Benefits and drawbacks. Use of the AMP has increased quickly in a short time period. This is likely because: (a) its internal reliability is one of the highest among implicit measures (approximately .70-.90; Gawronski & De Houwer, in press), (b) its number of trials in the task is one of the lowest of implicit measures, making it easy to use in a short experimental session, and (c) it is possible to calculate a relative preference or an attitude toward a single category. Note that AMP effects are more pronounced for participants who admit to directly rating the primes rather than the Chinese pictographs (Bar-Anan & Nosek, 2012; cf., Payne, Brown-Iannuzzi, Burkley, Arbuckly, Cooley, Cameron, & Lundberg, 2013). Additionally, Blaison, Imhoff, Huhnel, Hess, and Banse (2012) argue that the processes underlying the AMP might be more cold and rational than the name suggests. However, it remains an open question what this might mean for interpreting the AMP (as in Imhoff, Schmidt, Bernhardt, Dierksmeier, & Banse, 2011;

Sava et al., 2012). Finally, it is important to note that the AMP cannot be used with participants who are familiar with Chinese pictographs.

The Implicit Relational Assessment Procedure (IRAP; Barnes-Holmes, Hayden, Barnes-Holmes, & Stewart, 2008)

General procedure. The IRAP is based on the idea that we can understand attitudes by understanding verbal relations between relevant stimuli. On each trial of the IRAP, participants see two stimuli, one from one of two attitude categories (e.g., “old people” and “young people”) and, underneath that, one from one of two evaluative categories (e.g., “good” or “bad”). Participants are asked to respond using two keys, where one key (e.g., “D”) indicates that the two words are “similar” and the other key (e.g., “K”) indicates that the two words are “opposite”. This occurs in two sets of blocks, the rules for which only become clear to participants as they receive feedback during the task. During the “consistent” block, a red “X” informs participants that they have made an error when they choose “Similar” for the pairing “old people” and “good”; during the “inconsistent” block they receive error feedback when they choose “Similar” for the pairing “old people” and “bad”. The participant must then make the correct classification in order to continue, thereby reinforcing the rules of the particular block. The IRAP is scored by calculating the average latency to complete the block under the two rules, so that a faster score when “old people” and “bad” (and “young people” and “good”) necessitate a “similar” response than when they require an “opposite” response indicates an implicit preference for young people relative to old people.

The IRAP has not been used extensively, but appears to have promise as an implicit measure. It has been successfully modified to measure attitudes toward age groups (Cullen, Barnes-Holmes, Barnes-Holmes, & Stewart, 2009), food (Barnes-Holmes, Murtagh, Barnes-

Holmes, & Stewart, 2010), the self (Vahey, Barnes-Holmes, Barnes, Holmes, & Stewart, 2010), nationalities (Power, Barnes-Holmes, Barnes-Holmes, & Stewart, 2009), and overweight people (Roddy, Stewart, & Barnes-Holmes, 2010) in addition to proving able to index newly-formed attitudes (Hughes & Barnes-Holmes, 2011).

Relation to behavior and other measures. Although it has been used infrequently, the original authors of the IRAP argue that it shows predictive validity comparable to the IAT (e.g., Barnes-Holmes et al., 2010; Roddy et al., 2010). A spider-evaluation IRAP distinguished between participants high and low in spider fear and predicted approach behavior toward a tarantula (Nicholson & Barnes-Holmes, 2012).

Benefits and drawbacks. One benefit of the IRAP is that it seems to be relatively immune to faking strategies (McKenna, Barnes-Holmes, Barnes-Holmes, & Stewart, 2007). The IRAP has been used rarely outside of the original authors and, as such, relatively little is known about its strengths and weaknesses.

Conclusion

The measures described in this chapter measure can be considered “implicit” to the extent that the measurement outcome relies on processes that are some combination of uncontrolled, unintentional, autonomous, unconscious, efficient, or fast (De Houwer & Moors, in press). Each is designed to promote a more complete understanding of attitudes by providing an assessment of evaluations regardless of whether an individual is willing or able to introspect and self-report their attitude. Implicit measures were once thought to capture long-lasting and trait-like attitudes that would be less malleable than people’s self-reported attitudes. Indeed, some researchers even floated the premise that such measures had the potential to index a person’s “true” attitude (e.g., Fazio et al., 1995). Since that time it has become clear that there is no perfect measure of an

individual person's attitudes. Rather, implicit measures solve some problems with measurement (e.g., it is *relatively* difficult to fake results on them) while introducing new ones (e.g., effects of task recoding). This should not come as a surprise. After all, human evaluation is exceedingly complex even before attempting to measure attitude constructs that occur automatically or outside of conscious awareness. Clearly, the last two decades have been a "golden age" in attitude measurement as hundreds of researchers have tinkered with implicit measures – modifying them to measure countless attitude objects, while simultaneously fixing perceived flaws and continually creating new measures to diversify the ability to capture the essence of evaluations. We believe that the ongoing, vigorous debate over the use of implicit measures is a sign of a young and healthy field and look forward with great interest to the refinement of current measures and development of new measures that are sure to come.

It is important to note in closing that a great deal of methodological and statistical rigor has been brought to bear in the development of implicit measures of attitudes, both on the side of advocates of such measures and on the side of "intellectual opponents". Indeed, the sophistication and range of these measures and conversation surrounding them has been quite remarkable. However, it remains the case that implicit measures should be used with appropriate caution. For example, while millions of people have gained insight into their implicit attitudes at websites where you can try an implicit measure and receive feedback, such as <https://implicit.harvard.edu>, even researchers with the utmost confidence in the utility of implicit measures for such purposes would be extremely hesitant to use the results of a single test for diagnostic purposes. Implicit measures are currently inappropriate to use for labelling an individual person – especially based on an individual experience with an individual measure. That said, implicit measures are powerful indicators of group-level biases which have quickly

increased our knowledge base in dramatic ways across a wide-variety of fields. Quite simply, the invention - and continued innovation of - implicit measures of attitudes has fundamentally altered our understanding of evaluations.

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