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# 1

# The New Implicit Measures

## *An Overview*

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Numerous contemporary attitude theorists have made a distinction between implicit and explicit measures of attitudes, and sometimes a related distinction between implicit and explicit attitudes as well. Research on this topic is exploding at a phenomenal rate (see Fazio & Olson, 2003; Wittenbrink & Schwarz, 2007). Thus, it is interesting to note that although the implicit-explicit distinction has become very popular recently, it actually has been around in one form or another for a long time. For example, in their classic treatise on persuasion, Hovland, Janis, and Kelley (1953) defined *attitudes* as "implicit responses" that were "sometimes unconscious" and were "oriented toward approaching or avoiding a given object" (p. 7). Attitudes were contrasted with *opinions*, which were "verbal answers that one covertly expresses to (oneself)" (p. 8). These private opinions were further distinguished from public opinions, which could be susceptible to social desirability motives.

## Contemporary Meanings of Implicit

In current literature, the term *implicit* is sometimes applied to the attitude itself (as was the case with the usage of Hovland and colleagues) and is sometimes applied to the attitude measure (Fazio & Olson, 2003; Petty, Wheeler, & Tormala, 2003). When applied to the measure, the most common meaning of the term implicit is that people are unaware of what the measure is assessing, in contrast to an explicit measure,

in which people are fully aware that a self-report of their attitude is being requested. In this sense, there is full overlap with what prior texts on attitudes have called *indirect* or *unobtrusive* measures of attitudes (e.g., Petty & Cacioppo, 1981; Webb, Campbell, Schwartz, & Sechrest, 1966). Direct attitude measures are those that simply ask respondents to report their attitudes. Because these measures are transparent and make it obvious that attitudes are being assessed, they can be considered *explicit* measures. Included in this category are attitude measurement devices such as the semantic differential (Osgood, Suci, & Tannenbaum, 1957), the Likert scale (Likert, 1932), the Thurstone scale (Thurstone, 1928), and the ubiquitous one-item rating scale.

Indirect attitude measures, on the other hand, are those that do not directly ask the individual to report his or her attitude. Such measures were to be used when it was either impractical or undesirable to ask people what their opinions were (e.g., assessing interpersonal attraction with seating distance so as not to disturb the interaction), or there was some possibility that people might not be willing to tell you what their attitudes were (e.g., because of social desirability concerns or fear of retribution). When using indirect measurement approaches, the individual's attitude is inferred from his or her judgments, bodily responses, or overt behaviors. Because these measures do not make it obvious that attitudes are being assessed, they can be considered implicit measures.

A person completing an implicit measure is presumably unaware that the measure is assessing attitudes. Included in this category are a wide variety of methods such as the Thematic Apperception Test (TAT; Proshansky, 1943) and the information error test (Hammond, 1948); physical behaviors such as nonverbal gestures, eye contact, or seating distance (e.g., Dovidio, Kawakami, Johnson, Johnson, & Howard, 1997); picking up "lost letters" (Milgram, Mann, & Harter, 1965); and physiological measures such as skin conductance (Rankin & Campbell, 1955), pupillary dilation versus constriction (Hess & Polt, 1960), and facial muscle activity assessed with electromyography (EMG; Cacioppo & Petty, 1979). By the criterion of lack of awareness of what the attitude measure assesses, the new implicit measures are seen primarily as an attempt to improve upon the earlier and now classic indirect approaches.

In addition to accepting the idea that an implicit measure should be one that does not obviously assess attitudes, some researchers further emphasize that some implicit measures tap into an automatic evaluative reaction—one that comes to mind spontaneously upon the mere presentation of the attitude object (e.g., Fazio, Sanbonmatsu, Powell & Kardes, 1986; see De Houwer, 2006), rather than a more deliberative assessment



that comes to mind upon some reflection. Although in Hovland's day, all that could be measured were explicit or deliberative evaluations (what Hovland called "opinions"), today it is possible to assess automatic evaluative reactions. It is difficult to know exactly what was the first shot fired in establishing the current wave of research on automatic measures of attitudes, but it likely had to do with the growing acceptance of the idea that attitudes could be characterized as object-evaluation associations in memory that could vary in their accessibility (see Fazio, 1995). Furthermore, the voluminous research on associative priming in cognitive psychology (e.g., *doctor-nurse*; Meyer & Schvaneveldt, 1971) inspired efforts in social psychology to examine the automatic associations people had to social objects rather than just physical ones.

One of the earliest examples of this approach was provided by Gaertner and McLaughlin (1983), who attempted to assess automatic racial stereotypes. In their research the goal was to see if presenting participants with either the words *white* or *black* would facilitate lexical decisions about positive and negative stereotype words. One finding was that people were faster to identify positive words (e.g., *smart*) as words when primed with white rather than black, suggesting the presence of automatic stereotypes at least with respect to differential possession of positive traits.

Although various priming tasks continue to be used to assess specific beliefs that automatically come to mind (e.g., Wittenbrink, Judd, & Park, 1997), this volume is concerned with an even more popular topic: assessing the general evaluations that automatically come to mind when people are exposed to an attitude object. Two implicit measurement approaches have attained widespread use. The first, called the *evaluative priming measure* (Fazio, Jackson, Dunton, & Williams, 1995), examines the extent to which attitude objects selectively facilitate categorization of common words as positive or negative. The basic idea is that priming people with stimuli that they evaluate positively (e.g., *puppies*) should make it easier to categorize other positive stimuli as good, but make it more difficult to categorize negative stimuli as bad. For negative targets (e.g., *cancer*), the opposite should be the case.

In the second popular measure, the Implicit Association Test, or IAT (Greenwald, McGhee, & Schwartz, 1998), researchers compare how quickly people can categorize attitude objects of interest (e.g., male versus female names) when the target categories are paired with the good versus the bad response on a computer keyboard. For example, if one computer key represents both *female* and *good*, and the other key represents both *male* and *bad*, will a person categorize the female name

*Linda* faster or slower than when one computer key represents female and bad and the other key represents male and good? The assumption of the IAT is that if people evaluate females more positively than males, they should be faster to categorize the name Linda in the first situation than the second. Although conceptual analyses regarding exactly what the evaluative priming measure and the IAT assess and why they work can be complex, both measures assume that attitude objects can be linked to evaluative associations in memory that vary in strength.

It is important to note that the automatic versus deliberative distinction is not the same as the indirect versus direct one. This is because both direct and indirect attitude assessments can vary in the extent to which they permit deliberative responding (Vargas, von Hippel, & Petty, 2001; Vargas, 2004). For example, experimenters could require individuals to report their attitudes on a direct one-item rating scale with plenty of time for thinking, or extremely quickly with no time for deliberation. The one-item rating scale is a direct measure in that it explicitly asks people for their attitudes, but the circumstances under which it is completed could facilitate getting at a quick gut reaction or a more deliberative assessment (Wilson, Lindsey, & Schooler, 2000). Similarly, some indirect attitude measures permit relatively slow and deliberate responding (e.g., the Thematic Apperception Test or information error test), whereas others require very fast responses (e.g., the IAT or evaluative priming measure). Thus, when some theorists speak of implicit measures, they are referring to measures that both are indirect and tap into automatic evaluative reactions, whereas explicit measures are characterized by requiring a self-report and encouraging at least some deliberation. The natural confounding of these two categorizations could explain why implicit (indirect/automatic) measures tend to predict spontaneous behavior better than deliberative behavior, whereas explicit (direct/deliberative) measures tend to do the reverse (e.g., Dovidio et al., 1997). That is, prediction of behavior from attitudes is best the closer the correspondence in measurement each construct is.

The third and most controversial meaning that is sometimes applied to implicit measures is that they are assumed to assess an attitude of which people are unaware. Recall that Hovland, Janis, and Kelley noted that attitudes were sometimes unconscious (1953), and it is this possible aspect of attitudes that has intrigued some contemporary theorists as well (e.g., see Kihlstrom, 2004). That is, just as cognitive psychologists have shown that people can show traces of memory for some past event without any conscious recollection of that event (implicit memory; see Schacter 1987; Roediger 1990), so too might people show evidence of



attitudes without having any conscious access to the attitude itself. However, just because some implicit memory or attitude measure detects an effect of memory or attitudes, it does not mean that an explicit measure would not detect the same memory or attitude.

In the domain of memory, if an implicit measure detects an effect of the memory but people report no recollection of the memory, it seems reasonable to conclude that people have no conscious awareness of the memory. However, if an explicit measure of attitudes shows no evidence of the attitude but an implicit measure does, the conclusion that people are not aware of the attitude is less clear. That is, although it is possible that people would not want to report certain memories that they actually have due to social desirability concerns, this seems all the more likely with respect to certain attitudes. The fact that correlations between explicit and implicit measures of attitudes are reduced for just those attitude issues for which social desirability is a concern (see Chapter 3, this volume) suggests that social desirability attenuates the correlation between explicit and implicit measures. On the other hand, some might argue that it is in just these sensitive areas where people would be most likely to repress or deny their true attitudes, leading to the discrepancy.

In general, the three views of implicit attitude measures (indirect, automatic, unconscious) vary in the extent to which implicit and explicit measures should be correlated with each other. If implicit measures assessed attitudes of which people were completely unaware, by definition implicit measures should not correlate with explicit measures at all. The fact that correlations are often not zero suggests that it is unwise to rely on an implicit measure to necessarily tap an unconscious attitude. On the other hand, if the correlation between an implicit and explicit measure in some domain or in a given experiment actually is zero, does this mean that the implicit measure is assessing an unconscious attitude? This inference is also not certain because there are many ways in which a zero correlation can come about. The most obvious is poor reliability or validity of either or both measures.

However, what if the correlation between an explicit and an implicit measure is zero, but each measure is predictive of some type of outcome, thereby demonstrating some reliability and validity? This effectively rules out the garbage measure possibility. Nevertheless, this too is not sufficient to argue that the implicit measure is tapping an unconscious evaluation. People could be completely aware of the evaluation that comes to mind, but deny its validity or applicability to the self. Furthermore, people could be aware of the evaluation that comes to mind,

accept it as their own, but have different motives regarding reporting it, leading some to report more favorable attitudes than they actually have and some to report less favorable attitudes, producing a zero correlation with the implicit measure. Thus, to infer that an implicit measure is tapping an unconscious attitude requires not only a zero correlation, but other evidence that people have no access to the opinion. Demonstrating this could involve using various other attitude measurement techniques designed to control for social desirability (e.g., the bogus pipeline; Jones & Sigall, 1971).

Although with respect to the awareness criterion, most attention has been paid to the idea that implicit measures might tap attitudes of which people are unaware, various theorists have emphasized other aspects of awareness. For example, Wilson and colleagues (2000) emphasized that implicit attitudes were automatic evaluations for which people were unaware of the origins of the evaluation even if they were aware of the attitude itself. Because individuals rarely, if ever, have complete access to all of the influences on their judgments (see Wilson & Hodges, 1992; Nisbett & Wilson, 1977), this criterion may not represent a viable means of making a distinction between implicit and explicit attitudes.

Still other researchers have highlighted the idea that implicit attitudes were automatic evaluations for which people were unaware of the consequences or impact of the evaluation on other judgments and behavior (e.g., Greenwald and Banaji, 1995; Greenwald et al., 1998). Again, because individuals are unlikely to be aware of all of the consequences of their attitudes, this criterion would seem to render nearly every attitude implicit. Furthermore, by this criterion, whether the attitude was considered implicit could vary from context to context (e.g., the person could be aware that a negative attitude was influential in one situation but not another). Consequently, this feature does not appear to be an optimal criterion for distinguishing implicit from explicit attitudes.

In sum, automaticity in addition to a dimension on which some theorists have argued that implicit attitudes differ from explicit attitudes is in awareness. That is, implicit attitudes are viewed as automatic evaluations for which people are unaware of what the attitude is, or where it comes from, or what effects it has. Only the first criterion appears to provide a unique role for implicit versus explicit attitudes, but this one is the most difficult to instantiate. Finally, it is important to note that these three types of awareness are not mutually exclusive. Any attitude can be characterized by all, none, or some subset of these criteria (Fazio & Olson, 2003; Petty et al., 2003). If people are not aware of what their attitudes are, they certainly cannot be aware of where the attitudes come from or what effect they have. However, if people are completely aware of their attitudes, they might not be aware of their origins or consequences.*



## The Chapters in This Book

This book highlights the past decade of research in social psychology on implicit measures of attitudes. If explicit and implicit measures of attitudes always showed the same effects, then implicit measures would not be of much use. The fact that there has been a groundswell of interest in implicit measures of attitudes suggests that they do not invariably show the same results. But, as the chapters in this book indicate, there is no consensus on how to understand these discrepancies. How one interprets discrepancies between implicit and explicit measures depends in part on one's assumptions about the nature of attitudes.

The two chapters in this book that immediately follow this introduction discuss two different ways to think about implicit versus explicit measures and any discrepancies that arise between them. As noted earlier, one common approach to attitude representation asserts that attitudes are best conceptualized as object-evaluation links in memory (e.g., Fazio, 1995; Fazio, Chen, McDonel, & Sherman, 1982; Fiske & Pavelchak, 1986). This idea helped set the stage for the new implicit measures that aim to assess automatic attitudes and is perhaps best represented by the Motivation and Ability as Determinants (MODE) model (Fazio, 1990). In brief, the MODE model holds that automatic measures of attitudes (e.g., evaluative priming; Fazio et al., 1995) tend to assess the stored evaluation that is associated with the attitude object, whereas more deliberative measures (e.g., semantic differential; Osgood, Suci, & Tannenbaum, 1957) tap the retrieved evaluative association along with the outcome of any downstream cognitive processes. Thus, if people express different attitudes on a deliberative measure compared with an automatic measure, it is presumably because they have engaged in some thought that modifies the initial automatic evaluative reaction that comes to mind. This thought can reflect additional mental contents that are activated by the context, or it can stem from impression management or correc-

* One can ask similar questions regarding automaticity as one can for awareness. For example, in addition to asking whether the attitude or measure is an automatic or deliberative one, one can ask if the process of attitude formation is automatic or deliberative, or whether the attitude exerts its influence on behavior by an automatic or deliberative process.

tion motives. In Chapter 2, Olson and Fazio review work on the MODE model and explain how it can account for numerous outcomes on both implicit and explicit measures, along with their discrepancies.

A second approach to attitudes that has captured the attention of social psychologists more recently argues that people can hold separate explicit (conscious, deliberative) and implicit (unconscious, automatic) attitudes (e.g., Greenwald & Banaji, 1995; Wilson et al., 2000), which can take on different values. Although there are several versions of the dual attitudes approach, one or more of the following assumptions about attitudes are usually made (see Petty, Briñol, & DeMarree, 2007). First, the dual attitudes (implicit and explicit) are thought to have separate mental representations that are stored in separate brain regions (e.g., see DeCoster, Banner, Smith, & Semin, 2006; Wilson et al., 2000). A second common assumption is that the two attitudes stem from distinct mental processes. Implicit attitudes are said to result from relatively automatic associative processes, whereas explicit attitudes stem from more deliberative propositional processes (e.g., Rydell, McConnell, Mackie, & Strain, 2006). Third, implicit and explicit attitudes are postulated to be relatively independent and to operate in different situations (see Dovidio et al., 1997). When considering all of these assumptions together, the dual attitudes framework suggests that attitudes assessed with automatic and deliberative measures are quite different. The issue of whether implicit and explicit measures tap into a single- or a dual-attitudes structure is addressed by Greenwald and Nosek in Chapter 3. After reviewing some relevant evidence, they explain why they believe that the single-versus-dual-representation debate cannot be resolved with behavioral data alone. Nevertheless, they argue that the available evidence, though not requiring dual representations, is consistent with the idea that implicit and explicit attitudes are best conceptualized as distinct constructs.

Following these chapters, the book moves to a series of chapters dealing with a variety of classic issues in the attitudes literature. Each chapter discusses a particular domain in which implicit measures have enriched our understanding beyond what explicit measures have revealed. We have grouped these chapters thematically into those dealing with (a) ambivalence and consistency, (b) prejudice, (c) self-esteem, (d) attitude change, (e) methodological issues, and (f) alternatives to the reaction time measures.

The two chapters in the next section deal with issues involving cognitive consistency and ambivalence. What can implicit measures tell us about these classic phenomena? In Chapter 4, Gawronski, Strack, and Bodenhausen explain how implicit measures can contribute to our understanding of cognitive consistency paradigms such as those involving cognitive balance (Heider, 1958) and dissonance (Festinger, 1957). Gawronski and colleagues explain how both simple associative processes as well as more cognitively complex propositional processes play an important role.



In their approach to consistency, Gawronski and colleagues rely on their Associative Propositional Evaluation (APE) model of attitudes (Gawronski & Bodenhausen, 2007). This framework holds that people can respond positively or negatively to some attitude object based solely on the affect that is activated by that object, or based on the propositions that come to mind with respect to the object. The affect associated with an object can be detected directly by measures of automatic attitudes. Or, the affect can be detected by deliberative measures after it is translated into propositional form (e.g., "I like this.") and then checked for validity by an on-line process that examines whether the evaluative proposition is consistent with other salient propositions. In this framework, there are no stored evaluations (attitudes) per se, only stored affects and beliefs (propositions) that serve as input to the evaluations tapped by implicit and explicit measures.

Because the APE does not assume that there are stored evaluations, this perspective takes a very different approach to attitudes than the single- (MODE) or dual-attitudes models already described. That is, the APE focuses not on attitude structure but on the processes leading to evaluation.* In this constructivist perspective, attitudes are expressed, as needed, based on currently salient feelings and beliefs (see also Schwarz & Bohner, 2001; Wilson & Hodges, 1992). According to this approach, different contexts make different emotions or knowledge accessible, resulting in changes in people's evaluations. Any consistency in implicit or explicit attitude measures across contexts, according to this perspective, comes from the same set of building blocks being retrieved each time and being reflected in the current evaluation.

In Chapter 5, Petty and Briñol discuss the concept of implicit ambivalence and use yet another approach to attitudes to guide understanding of this phenomenon. This approach is referred to as the Meta-Cognitive Model (MCM; Petty & Briñol, 2006; Petty et al., 2007). The MCM shares some features with each of the approaches just described,

* If one assumes that the "affect" that forms the basis of the evaluation under automatic conditions is a stored evaluation, then the APE is similar to the MODE model described earlier.

but also has some differences. In brief, the MCM holds that attitude objects can be linked in memory to both positive and negative evaluations that can vary in the degree to which they are endorsed. Thus, in common with the MODE model, people are assumed to have stored evaluative representations. In common with dual-attitudes approaches, an attitude object can be linked to both positive and negative evaluative associations. In contrast with the dual-attitudes approach, however, the MCM assumes that any object can be linked to and thus jointly activate both evaluations rather than each evaluation being compartmentalized or isolated. In common with the APE, the MCM assumes that people assess the validity of their evaluations, but in contrast to the APE, the MCM holds that people can store validity information rather than necessarily constructing a new validity assessment on each occasion. If positive and negative evaluations are associated with an attitude object, but one valence is invalidated, automatic and deliberative attitude measures would yield different attitudes. The focus of Chapter 5 is on how these implicit-explicit discrepancies can lead to a state of implicit ambivalence. The chapter addresses how this differs from the more commonly studied explicit ambivalence in both origins and consequences.

Chapters 6 and 7 deal with prejudice. This is the domain in which the new implicit measures were first applied and is the research area in which more work has accumulated than any other. In Chapter 6, Dovidio, Kawakami, Smoak, and Gaertner provide an overview of a long-standing program of research on racial prejudice using implicit measures. The studies they review point to the utility of using implicit measures in this domain, allowing prediction of various outcomes that would not be expected from explicit measures alone. Chapter 7 by Amodio and Devine further explores the domain of prejudice. Amodio and Devine argue that to understand prejudice, it is necessary to distinguish between stereotyping and more general evaluative forms of racial biases. They argue that these core components of racial prejudice stem from affective processes versus semantic associations, and that these two forms of racial bias interact with behavior in different ways.

Besides prejudice, the topic where implicit and explicit measures have been most popular is in the domain of self-esteem. The next two chapters tackle this subject. In Chapter 8, Dijksterhuis, Albers, and Bongers examine the meaning of implicit and explicit measures of self-esteem. In accord with the MODE model, they argue that implicit measures tap one's core self-esteem, whereas explicit measures are more influenced by self-deception and impression management. In Chapter 9, Jordan, Logel, Spencer, Zanna, and Whitfield take a somewhat different approach, arguing that implicit and explicit self-esteem represent distinct self-evaluations that operate within separate, though interacting, psychological systems. Their chapter focuses on the behavioral consequences of having discrepant implicit and explicit self-esteem, with special attention paid to individuals who have high explicit but low implicit self-esteem.



The next two chapters address the topic of attitude change. Although hundreds of studies examine attitude change and persuasion with explicit measures, it is only recently that persuasion work has begun to examine the impact of attitude change techniques on implicit measures and to examine the mechanisms by which these measures are impacted. In Chapter 10, Briñol, Petty, and McCaslin consider attitude change processes that range from those using simple automatic associations (e.g., evaluative conditioning) to those involving more deliberative forms of reasoning (e.g., elaborating the arguments in a persuasive message), and how these processes influence both automatic and deliberative assessments of attitudes. In reviewing the research on this issue, the conditions under which the different processes of change affect both kinds of measures versus just one are articulated. In Chapter 11, Maio, Haddock, Watt, and Hewstone first provide an overview of the use of implicit measures in applied persuasion contexts such as consumer attitudes and health disorders. Then, they describe a case study demonstrating the utility of using implicit measures to assess the effectiveness of an antiracism media campaign.

The next chapters address various conceptual and methodological issues that have arisen in understanding exactly what the new wave of implicit measures—especially those aiming to tap automatic evaluations—actually measure. In Chapter 12, De Houwer describes two levels at which different implicit measures can be compared. One is at the functional level. De Houwer considers what functional properties are assumed by researchers using different implicit measures (e.g., "Is the measure controllable?") and what are the conditions under which the various measures operate as intended. Second, measures are compared at the procedural level. For example, De Houwer argues that depending on the specific procedure used, an implicit measure might better assess attitudes at the category level (e.g., *insect*) or at the exemplar level (e.g., *cockroach*). In Chapter 13, Sherman also addresses some important methodological issues. In particular, he explains that although many researchers have assumed that implicit measures uniquely tap into automatic processes, such measures are not process-pure; that is, these measures can also be influenced by more deliberative processes. In his

chapter, Sherman articulates the Quadruple Process (Quad) Model (Conrey, Sherman, Gawronski, Hugenberg, & Groom, 2005) as a means of estimating the extent of various automatic and controlled influences on implicit measures.

All of the chapters in the volume to this point have focused primarily on implicit measures that aim to assess automatic evaluative reactions with procedures relying on reaction times (e.g., how quickly can people categorize *beauty* as a positive word after being primed with *Chinese*). Although these measures have proven amazingly popular and useful, they are not the only new measurement techniques developed in the last decade. Our final set of chapters tackles alternative approaches to the implicit measurement of attitudes. In Chapter 14, von Hippel, Sekaquaptewa, and Vargas examine the ways in which a person's use of language can provide implicit assessments. For example, the spontaneous use of *we* versus *I* can be employed to assess the extent to which a person feels part of a group. In their chapter, von Hippel and colleagues provide a fresh perspective on some classic indirect approaches such as projective tests and also review more contemporary indirect techniques that rely on linguistic markers of attitudes. In Chapter 15, Payne presents his Affect Misattribution Procedure (AMP). In brief, with this technique, inferences about people's attitudes are made based on how they judge ambiguous objects after being exposed to the attitude object of real interest. The key idea is that a person's reaction to the target object (e.g., a picture of a presidential candidate) can be misattributed to the subsequently presented ambiguous object (e.g., a Chinese ideograph; see Murphy & Zajonc, 1993). In Chapter 16, Cunningham, Packer, Kesek, and Van Bavel provide an overview of the various physiological measures of attitudes that have been used over the years from skin conductance to state-of-the-art brain imaging approaches. Cunningham and colleagues view evaluations of attitude objects as continually being updated, with implicit evaluations involving relatively few iterations of the evaluative system and a reduced set of cognitive operations, whereas explicit evaluations involve many iterations and more cognitive operations.

## Conclusion

As should be evident by now, the goal of this book is not to provide a "how to" handbook on using implicit measures. There are many good sources available for this. Rather, the chapters in this book outline several conceptual approaches for understanding what implicit measures



assess and how they are useful in understanding classic as well as very new phenomena in the attitudes literature.

It is important to note that the chapter authors do not necessarily agree on the most appropriate and productive definition of implicit attitudes and measures and how they should be conceptualized. To avoid confusion, however, we have asked each author to be as clear as possible in making his or her underlying assumptions and definitions transparent. Thus, as a reader, we hope that by the time you have finished this volume, you will find that one approach is more appealing than another, or you will formulate and adopt your own unique perspective on the new implicit measures and their utility.

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