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Methodological Correctness of Research in Measuring Implicit Attitudes: a Systematic Review[1]*

Mila Guberinić**
Department of Psychology, Faculty of Philosophy, University of Niš, Serbia

Abstract

Implicit measures of attitudes provide an assessment of attitudes that respondents are unwilling to express or might not be aware of. This paper presents a systematic review of scientific literature in the field of measuring implicit attitudes, in which the current state and position of this construct are reviewed with the aim of assessing the meeting of scientific methodological criteria of knowledge acquisition. Empirical materials were obtained in February 2023 through the following search engines and platforms: Google, Google Scholar, SAGE, APA PsycNet, EBSCO, ScienceDirect, ResearchGate and JSTOR. Inclusion criteria: a paper published in a scientific journal, in English, available in its entirety in electronic form, in the field of psychology/social sciences, published from 2000 to the date of the search. In most reviewed sources, the Implicit Association Test (IAT) instrument was used, so this was added as an inclusion criterion. The final number of studies for analysis was 22 – five review papers and 17 research papers, mostly experimental studies. The papers were published in scientific journals with a high impact factor, written in the IMRAD format, the methods used were adequately presented, systematically controlled research procedures and appropriate statistical techniques were used, the conclusions were based on data, and the critical attitude of the researchers is present. The metric characteristics of the instruments are generally at an acceptable level – adequate internal consistency reliability, convergent and internal validity, predictive ability, but there are problems in the domain of construct and ecological validity.

Keywords: implicit attitudes, measures, systematic review, IAT

[1] Corresponding author: mila.guberinic@filfak.ni.ac.rs
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** https://orcid.org/0000-0001-6926-0220

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Implicit attitudes are introspectively unidentified (or incorrectly identified) traces of past experience that mediate a favourable or unfavourable feeling, thought, or action toward social objects (Greenwald & Banaji, 1995). According to the APA psychological dictionary, a measure of implicit attitudes is any attitude evaluation procedure in which a person is not aware of the fact that their attitude toward something or someone is being evaluated (APA, 2023).

In the social sciences, the dominant method of measuring attitudes is the collection of explicit self-reports in the form of self-rating scales. However, since the early days of attitudinal research, researchers have often been concerned that respondents may sometimes be unwilling or unable to report their attitudes in an unbiased manner (DeMaio, 1984, as cited in Wittenbrink & Schwarz, 2007). Research has shown that respondents' answers are highly context-dependent and vary as a function of who asks, how they ask, and related variables (Schwarz et al., 1998; Sudman et al., 1996; Tourangeau et al., 2000, as cited in Wittenbrink & Schwarz, 2007). Some of these context effects reflect the presence of strategic responding, while others reflect cognitive and communicative processes involved in question comprehension and judgment formation. Psychologists have set out on a quest to find a measure of attitudes that does not rely on participants' introspection and honesty (Vargas et al., 2007). The concerns of the scholars on this topic have encountered different methodological and theoretical responses, which can be classified into three categories. One category of responses includes retaining explicit self-reports as the key measure for assessing attitudes. In doing so, the presumed reluctance of respondents to accurately report their attitudes is resolved by minimizing incentives for socially desirable responding by applying procedures ranging from simple assurances of anonymity to complex randomization techniques (Bradburn et al., 2004, as cited in Wittenbrink & Schwarz, 2007). The second category of methodological approaches attempts to assess the evaluative responses of research participants in ways that circumvent any opportunity for strategic responding, thus relying on assessment of physiological responses and brain activity (Ito & Cacioppo, 2007; Olsson & Phelps, 2007), but this will not be the topic of this paper.

The third category of methodological responses that addresses a potential solution to concerns about response bias replaces explicit self-reports of attitudes with indirect measures. Since respondents are likely unaware of the relationship between indirect measures and their attitudes, the assumption is that these measures minimize incentives and opportunities for strategic responding. Theoretically, the use of indirect measure is based on the assumption that attitudes exert a systematic influence on people's performance regarding various tasks and that the size of this effect can serve as an index of underlying attitude. Implicit measures of attitudes provide an assessment of attitudes that respondents are unwilling to express directly or may not even be aware of (Wittenbrink & Schwarz, 2007). Throughout the history

of attitude research, these measures have taken different forms in accordance with historical changes in the basic conceptualization of attitudes – from the early use of projective tests (Proshansky, 1943, as cited in Wittenbrink & Schwarz, 2007), to currently contemporary measures of response latency – sequential priming procedure and response competition procedure (Lane et al., 2007; Wittenbrink, 2007), and a low-tech "pen-paper" alternative (Vargas et al., 2007). In this paper, we will deal with approaches from this category.

One of the accepted conceptualizations of attitudes, within the implicit measurement approach, defines attitudes as stored object–evaluative associations that are automatically activated upon exposure to the attitude object (Fazio, 1995, as cited in Wittenbrink & Schwarz, 2007) and relies on priming procedures to assess the strength of the object-evaluation link. As Ferguson and Bargh (Ferguson & Bargh, 2007, as cited in Wittenbrink & Schwarz, 2007) emphasize, attitudes conceptualized and measured in this way are often assumed to be context independent.

Today, there are a number of measures for non-obtrusive or "implicit" measurement of an individual's valuation according to political, social, economic and personal topics, although the question of their reliability and validity is open. The most widely used implicit measures of attitudes today rely on response time measurement (Wittenbrink & Schwarz, 2007). These aforementioned measures take advantage of one of two reliable observations, namely, (1) sequential priming procedure - the observation that exposure to the initial concept (the prime) activates semantically related concepts in memory, thus reducing the time needed for their identification (e.g., the prime stimulus *doctor* facilitates subsequent responses to the related stimuli *nurse*) or (2) the response competition procedure - the observation that a stimulus is responded to more slowly when it contains multiple features that each imply a different response (interference effects). The best-known response competition procedure is the Implicit Association Test (IAT) (Greenwald et al., 1998, as cited in Wittenbrink & Schwarz, 2007). The IAT presents discrimination tasks that are combined in specific ways across a sequence of five steps (more in the Method section below). It examines how quickly an attitude object can be categorized positively or negatively and ascribes importance to differences in milliseconds of the response time (Greenwald et al., 1998, as cited in Mitchell & Tetlock, 2015). These measures define attitudes as evaluative associations with an attitude object and do not require conscious approval of the evaluation or behavioral manifestation of the attitude which should be attributed to an individual.

This paper presents a systematic review of empirical literature in the field of measuring implicit attitudes from the year 2000 until the date of the literature search for this paper. To the best of the author's knowledge in the field of interest, there are some review papers with, to some extent, discordant results (e.g., Sherman & Klein, 2021; Brownstein et al., 2019; Dimofte, 2010; Nosek et al., 2011; Nosek, 2007) and there is a lack of a systematic review of empirical data, which is the rationale for conducting this research. Furthermore, the paper is concerned with inspecting the current state and position of the construct of implicit attitudes in science, with the aim of assessing the methodological correctness, i.e., the fulfilment of scientific

methodological criteria for the acquisition of knowledge and answers to the question of whether the empirical material from this field according to its characteristics belongs to the domain of "good practice" of scientific production. Being aware that question of demarcation between science and pseudoscience is still a subject of great debate among philosophers of science and scientists in general (Ferguson, 2015; Lakatos, 1978; Popper, 1963; Skinner, 1990; as cited in Hedrih & Hedrih, 2022), it can be also noted that there are some tendencies and regularities that can be used in practice as demarcation criteria for differentiating between real science and pseudoscience posing as science. Demarcation criteria (further described in the method section) proposed by Hedrih and Hedrih (2022) is used for evaluating the research methodology for measuring implicit attitudes applied in the units of analysis (published papers).

Method

Research procedure and acceptable sources

Empirical material for this work was obtained by searching sources in English, available in electronic form through Google, Google Scholar and electronic services for searching electronic scientific journals which are available through the service on the platform of the Serbian Library Consortium for Coordinated Acquisition (KoBSON). The search was carried out by the author of this paper in February 2023 (12th and 13th) by specifying keywords (implicit attitude measure) in the specified search engines. First, a preliminary review of the available literature was made through the Google in order to assess the representation of the studied topic in non-scientific sources and scientific journals, and then a search was continued through the Google Scholar search engine exclusively for scientific journals of all categories from the year 2000 to the date of the search because quite a few of such sources appeared in the initial search.

Criteria for Source Inclusion

- Published paper (review or research) in a scientific journal.
- The paper is in English.
- The paper is available in its entirety in electronic form through the used browsers/services.
- The paper was published since 2000 until the date of the search.
- The paper is from the field of psychology/social sciences.

Literature search, collecting and selecting units of analysis

The literature search commenced with the Google search engine on February 12, 2023 according to the following key words: implicit attitude measure, and the criterion was set that the sources should not be older than the year 2000. The first three pages in this search engine were reviewed and out of 28 items 14 were academic articles (one of which was repeated three times, one was published before 2000, one was not from the field of psychological/social sciences but from the IT field, two papers were not available in their entirety, three units were chapters in a book - a monograph by a well-known publisher (out of which one unit was repeated twice), three units were monograph books by a well-known publisher (one was repeated), one master's thesis, one unpublished meta-analysis, two units were from dictionaries, i.e., psychological encyclopedias, three units were popular/psychoeducational websites and one unit was a blog. Since more than a half of the reviewed units were related to academic articles and books, and the Google search engine offered an immediate option for the search of academic articles, the search was continued through the Google Scholar search engine with the same given words, time frame and criteria in order to display the most significant results. The first three pages were reviewed in this search engine as well (12th 13th January, 2023) and out of 30 units, 25 were academic articles (one of which was repeated from the previous search), two units were chapters in a book – a monograph by a well-known publisher (one was repeated twice), another two units were monograph books by a well-known publisher (one was repeated) and one unit was a preprint of a scientific article.

As a result of the first search through the Google search engine, 8 papers were retained in their entirety from scientific journals, and as a result of the second search through the Google Scholar search engine, additional 24 papers were retained, which makes a total of 32 papers in their entirety (review and research) from the field of psychology/social sciences on the topic of measuring implicit attitudes. As only abstracts were mostly available via the Google and Google Scholar search engines, the papers were accessed in their entirety by using services on the KoBSON platform (SAGE, APA PsycNet, EBSCO, ScienceDirect), as well as the ResearchGate and JSTOR platforms.

Through a preliminary review of 32 papers in their entirety, it was observed that several implicit attitude measures appear in overview/theoretical papers (7 of them) and research papers (25 of them): Implicit Association Test (IAT) (Greenwald et al., 1998), Affective Priming Task (APT) (Fazio et al., 1986), Affective priming (Degner & Wentura, 2010), Semantic Priming Task (SPT) (Wittenbrink et al., 1997), Affect Misattribution Procedure (AMP) (Payne et al., 2005), Manikin task (De Houwer et al., 2001), ID-EAST (Huijding & De Jong, 2005), GNAT (Nosek & Banaji, 2001), The Brief Implicit Association Test (BIAT) (Sriram & Greenwald, 2009), The Single Category Implicit Association Test (SC-IAT) (Karpinski & Steinman, 2006), and Child IAT (Baron & Banaji, 2006).

By reviewing the articles further, it was concluded that 25 of them (out of a total of 32) use the Implicit Association Test (IAT) (Greenwald et al., 1998) as the only implicit measure of attitudes or in some cases with other instruments. Due to the dominant representation of this instrument, and for the sake of a more homogenous

sample of analysis units, it was decided *to narrow the topic of this paper* to only this measure of implicit attitudes (the Implicit Associations Test - IAT) and to analyze further only the research papers (18 of them) in which this test is used, or review/ theoretical works (7 of them) in which it was critically examined. Therefore, this selection does not include two papers that use a significantly modified version of this instrument - the Single-category version (SC-IAT) (Muschalik et al., 2019) and the Brief version (BIAT) (Sriram & Greenwald, 2009), as well as the papers of other authors that use other instruments (Dalege & van der Maas, 2020; Echabe, 2013; Genschow et al., 2017; Olson & Fazio, 2001; Spence & Townsend, 2007).

Moreover, a more detailed review of the papers in their entirety found that the two theoretical papers, in which the IAT instrument was reviewed, were focused primarily on the field of economics (Bertrand et al., 2005) and law (Greenwald & Krieger, 2006), and not on the field of psychology like the remaining papers, so these two papers were also excluded from further analysis, thus leaving 5 review papers in the selection.

As far as the samples of respondents in the remaining research papers (18 of them) are concerned, in 17 papers the sample consists of adult respondents, and in 15 cases it is composed of students, one sample includes teachers and another one health workers. In only one paper (Baron & Banaji, 2006), the main goal was to compare the performance of children and adults on the IAT and the development of implicit attitudes, which made us exclude this paper from further analysis. Thus, the total number of papers for analysis is 22.

Measure used in units of analysis

Implicit Associations Test (IAT) (Greenwald et al., 1998) assesses the association between a *target-concept discrimination* and an *attribute dimension.* It presents discrimination tasks that are combined in specific ways across a sequence of five steps: 1) initial target-concept discrimination, 2) evaluative attribute discrimination, 3) first combined task, 4) reversed target-concept discrimination, and 5) reversed combined task. The procedure starts with the introduction of the target-concept discrimination. This and subsequent discriminations are performed by assigning one category to a response by the left hand and the other to a response by the right hand on the computer keyboard. The second step is the introduction of the attribute dimension, also in the form of a two-category discrimination. These (target-concept and attribute) are combined in the third step and then recombined in the fifth step, after reversing response assignments (in the fourth step) for the target-concept discrimination. As a matter of interest is the speed with which participants can perform the two superimposed discrimination tasks at step 3 and step 5, and an *IAT effect* is defined as the difference in mean latency between these two conditions (steps).

For example, to assess attitudes toward African Americans and European Americans, the first discrimination task presents names that are typical for the respective group and asks participants to categorize each name as “White” versus “Black.” They do so by pressing a response key assigned to “White” with the left hand or

a response key assigned to "Black" with the right hand. Next, the second discrimination task presents words with pleasant (e.g., love) or unpleasant (e.g., poison) connotations, which participants classify by pressing the left or right response key. At the third step, these two tasks are superimposed and participants press the left key when either a White name or a pleasant word is shown, but the right key when either a Black name or an unpleasant word is shown. This task is easier (done faster) when evaluatively associated categories share the same response key—for example, when White participants press the left key to categorize White names and pleasant words. At the fourth step, the assignment of keys to White and Black names is reversed, so that participants who first used the left key for White names now use the left key for Black names. Finally, the two discrimination tasks are again superimposed, resulting in an assignment of "Black" and "pleasant" to the left response key and "White" and "unpleasant" to the right response key. In the present example, a faster response at step 3 compared with the response at step 5 is thought to indicate that White names and positive evaluations, and Black names and negative evaluations, are more strongly associated than the reverse pairings.

Procedure for assessing and evaluating units of analysis

For evaluating the methodological correctness (adequacy) of research methodology for measuring implicit attitudes applied in the units of analysis (published papers) criteria for demarcation between science and pseudoscience proposed by Hedrih and Hedrih (2022) were used:

1. publishing results: Scientific work is primarily first published for experts, undergoes review and intense examination and scrutiny by other experts; it is published for the general public only after it successfully passes evaluation by experts. Conversely, pseudoscience targets the general public and review or evaluation by experts is actively avoided. This criterion was assessed through inspecting sources where the papers included for analysis are published (list, impact factor).
2. replicable results: Science requires replicable results, procedures are described in sufficient detail for other scientists to be able to replicate them and thus verify results themselves, whereas in pseudoscience, results cannot be verified due to vaguely described procedures. This criterion was assessed through inspecting papers included for analysis in their entirety, with special focus on indicators in the method section.
3. treatment of errors: In science, errors are actively sought in order to correct them, whereas in pseudoscience errors are ignored, hidden, and initial concepts are never abandoned. This criterion was assessed through inspecting papers included for analysis in their entirety, with the focus on the author's awareness of possible errors and places for improvement, as well as the critical stance, especially in discussion and limitations sections.
4. progress of knowledge: Science progresses; with new studies the quantity of knowledge about the phenomenon and its underlying physical

processes increases, whereas in pseudoscience there is no progress with time. This criterion was assessed through inspecting papers included for analysis in their entirety, with the focus on indicators of improved knowledge of researched phenomena, especially in the results, discussion, and conclusion sections.

5. use of evidence: Science convinces through presenting evidence and logical arguments, whereas pseudoscience tries to get people to believe in it even in spite of existing evidence, not because of it. This criterion was assessed through inspecting papers included for analysis in their entirety, with the focus on type of evidence and supporting arguments used especially in the results and discussion sections.
6. how it is supported: Scientific products undergo rigorous examinations and testing before being placed on the market, whereas the sale of problematic products, either ineffective or detrimental, is the main source of income for pseudoscience. Due to the nature of units of analysis, it is not expected to have the data needed to evaluate according to this criterion, but if such material occurs through detailed inspection of papers included for analysis, it will be assessed.

In accordance with good practice and valid conduct in performing the psychological testing, ethical principles codified in codes of ethics were used (codes of ethics are created by national associations of psychologists in each country). As an evaluation criterion for assessing papers included in the analysis, we used two widely known codes of ethics – United states of America APA Ethical Principles of Psychologists and Code of Conduct (2016), and Code of Ethics and Conduct (2018) of the British Psychological Society.

In order to obtain a concise overview of the papers included in the analysis with basic study characteristics (source, study design, sample), abstracts and method sections of all papers were read and analyzed, as well as whether their form followed the IMRAD form of scientific articles (see Table 1). The obtained data was used mainly for evaluating according to the first criterion. For a more in-depth analysis of whether the research methodology of the included papers meets the set criteria, starting from the beginning of the list given in Table 1, seven original empirical papers (almost a third of the analysis units) were read, analyzed and evaluated in detail. Some of the papers from the list were excluded from the more detailed analysis due to the limitation of the length of this paper. Review papers were not included in this part of the evaluation.

Results

The process of selecting units of data, inclusion and evaluation criteria is already described in detail in the Method section above. The following Table 1 will show a concise overview of the papers included in the further analysis, their basic characteristics and the characteristics of the sources in which they were published.

Table 1

Overview of studies included in the systematic review

	Information about the study					Sample		IAT reliability
No.	**Author (year)**	**Source (journal, list, IF[3])**	**IMRAD form**	**Study design**	**Country**	**Respondent source**	***N***	
1.	Sherman & Klein (2021)	Frontiers in Psychology (SSCI[1], 4.23)	yes	Review				
2.	Cunningham et al. (2001)	Psychological Science (SSCI, 2.76)	yes	Experiment	USA	Students for ECTS[4]	93	α = .78
3.	Brownstein et al. (2019)	WIREs Cognitive Science	yes	Review				
4.	Friese et al. (2008)	British Journal of Social Psychology (SSCI, 1.70)	yes	Experiment 3 studies	Switzerland	Students (Female)[4] (for ECTS)[4] Students (Male) for 10€[4]	88; 66; 45	α = .93
5.	Dimofte (2010)	Psychology and Marketing (SSCI, 1.38)	yes	Review				
6.	Nosek et al. (2011)	Trends in Cognitive Sciences (SSCI, 12.58)	yes	Review				
7.	Nosek (2007)	Current Directions in Psychological Science (SSCI, 2.75)	yes	Review				
8.	Petty et al. (2006)	Journal of Personality and Social Psychology (SSCI, 4.22)	yes	Experiment 4 studies	(USA) Spain (USA) (USA)	Students for ECTS[4]	(98); 70; (77); (45)	
9.	Rydell & McConnell (2006)	Journal of Personality and Social Psychology (SSCI, 4.22)	yes	5 experiments	USA	Students for ECTS[4]	170; 186; 113; 29;	

							50	
10.	Perugini (2005)	British Journal of Social Psychology (SSCI, 1.81)	yes	(quasi-) experiment 2 studies	UK	Students for 2€[4]	48; 109	
11.	Kim (2003)	Social Psychology Quarterly (SSCI, 0.60)	yes	experiment 2 studies	USA	Students for ECTS[4]	64; 73	
12.	Van den Bergh et al. (2010)	American Educational Research Journal (SSCI, 2.47)	yes	Combined methods	Netherlands	Teachers for 10€[4] (students)	41; (434)	
13.	Karpinski & Hilton (2001)	Journal of Personality and Social Psychology (SSCI, 3.61)	yes	experiment 3 studies	USA	Students for ECTS[4]	43; 28; 85	
14.	Rudman & Kilianski (2000)	Personality and Social Psychology Bulletin (SSCI, 1.20)	yes	experiment	USA	Students for ECTS[4]	69	
15.	Banse et al. (2001)	Zeitschrift für Experimentelle Psychologie (0.31)	yes	experiment 2 studies	Germany	Students for ECTS[4]; voucher, -[4]	101; 79	$\alpha = .88$ $\alpha = .81$
16.	Karpinski & Steinman (2006)	Journal of Personality and Social Psychology (SSCI, 4.22)	yes	Experiment 4 studies	USA	Students for ECTS[4]	56; 66; 81; 84	$r = .82$ $r = .58$ $r = .75$ $r = .78$
17.	Brunel et al. (2004)	Journal of Consumer Psychology (SSCI, 0.85)	yes	experiment 2 studies	USA	Students for ECTS[4]	88; 93	
18.	Nosek et al. (2002)	Group Dynamics: Theory, Research, and Practice (SSCI, 0.70)	yes	experiment	USA	Online platform over 2 years	600,000	
19.	Teachman & Brownell (2001)	International Journal of Obesity (SCIE[2], 2.19)	yes	experiment	USA	Health workers[4]	84	
20.	Maison et al. (2004)	Journal of Consumer Psychology (SSCI, 0.85)	yes	quasi-experiment;	Poland	Students for $1.33[4];	40; 40;	

				experiment; quasi-experiment		General for $1.33[4]; Highschool students[4]	103	
21.	Turner & Crisp (2010)	British Journal of Social Psychology (SSCI, 2.05)	yes	experiment 2 studies	UK	Students for ECTS[4]	25; 29	$r = .58$ $r = .82$
22.	Swanson et al. (2001)	Cognition and Emotion (SSCI, 1.76)	yes	quasi-experiment	USA	Students for ECTS[4]	84; 196	

Note. [1]Social Sciences Citation Index (SSCI) – includes 3,400 of the world's most influential journals in 58 social science disciplines. More than 9 million records and 122 million cited references date from 1900 to the present; [2]Science Citation Index Expanded (SCIE) – includes more than 9,200 of the world's most influential journals in 178 scientific disciplines. More than 53 million records and 1.18 billion cited references dating from 1900 to the present (Downloaded from https://www.institut.edu.rs/sta-je-to-sci-lista-wos-i-kako-da-odaberem-casopis-iz-svoje-naucne-oblasti/ on 16th February, 2023); [3]Impact Factor; [4]convenient sample.

In accordance with the main subject of this paper, which includes a critical review of the research methodology for measuring implicit attitudes, in order to gain a better insight into the factual situation in this area and obtain more data for evaluation according to the set criteria, several papers from the above-mentioned list of studies (Table 1) will be analyzed in more detail. In the following text, research studies that investigate implicit attitudes by using the Implicit Association Test (IAT) (Greenwald et al., 1998) will be reviewed by employing mostly the original research procedures of the authors of this test (see IAT description in the Method section), with minor modifications and the stimulus change.

The second included study from the list in Table 1 (Cunningham et al., 2001) was a within-subject (repeated measuring) experimental design. The respondents gave their informed consent and the ethical principles of conducting research were adhered to. This paper presents an assessment of the internal consistency reliability, stability over time, and convergent validity of three implicit attitude measures. Attitudes toward members of the black and white races were measured on four separate occasions at a 2-week interval by using three relatively implicit measures (Response-Window Implicit Priming, Implicit Association Test – IAT – the subject of interest in this paper, and Response-Window Implicit Association Test) and one explicit measure (Modern Racism Scale). The order of implicit measures was randomized for each participant in each session. The order of implicit and explicit measures was counterbalanced. The research procedure is described in detail. Cronbach's alpha coefficient of internal consistency was calculated for each measure in all four measurements and for the IAT the mean value was .78, which is at a satisfactory level, but still a little lower compared to explicit measures of attitudes (Cunningham et al., 2001). Current conventions suggest that an internal consistency of .80 (20% error) or higher represents good reliability (Cronbach, 1951), although many widely used scales remain in the .70 range (Robinson et al., 1991, according to Cunningham et al., 2001). The stability indices were initially low, and after correction by the latent variable analysis (removing measurement error), the authors found that (a) the stability indices improved (for the IAT .68) and (b) the implicit measures were in a statistically significant correlation with each other and they formed one latent factor (thus demonstrating convergent validity). The explicit measure of attitudes has statistically significant correlations with all implicit measures (with IAT r= .30) and their latent factor. This does not mean that implicit and explicit measures of attitudes are identical, but it does suggest that there is not a complete dissociation between them either. The authors state that the psychometric properties of these implicit attitude measures are better in the replication study than in previous studies and there is an awareness of the limitations of the study.

In the fourth paper from the list in Table 1, the authors (Friese et al., 2008) present three experimental studies with a control group that aim to test the theoretical assumption of social psychology that explicitly measured attitudes are particularly valuable for predicting intentional, controlled behavior, and the opposite that implicitly measured attitudes are more important for predicting less controlled, more impulsive behavior. In Study 1, on average 10 days before the experimental

session, the explicit attitude measure about fruit and chocolate was assessed, and in the experimental session participants first completed the implicit measure IAT (with the target categories 'fruit' and 'chocolate' and the attribute categories 'pleasant' or 'I like' and 'unpleasant' or 'I don't like') followed by a short questionnaire, after which they completed the fruit-chocolate choice task which also contained low and high cognitive capacity working memory task (memorizing eight-digit or one-digit number). In Study 1, the working memory of respondents in the experimental group was temporarily encumbered with additional information intended to disrupt central executive functioning (memorizing eight-digit number), and this variable - cognitive capacity moderated the predictive validity of both explicitly and implicitly measured attitudes (IAT) in the fruit-chocolate choice task. Self-regulatory resources led to similar patterns regarding potato chips-eating behavior (Study 2) and beer-drinking behavior (Study 3). In addition to the predictive validity of measures of implicit and explicit attitudes, Study 3 explored more closely the relative contributions of explicitly measured attitudes and general standards of restraint as two distinct but complementary constructs that depend on control resources. However, Studies 2 and 3 used a significantly modified version of implicit attitude measure IAT - the Single-category version (SC-IAT), which is not a subject of interest in this paper. The results (obtained by using adequate statistical procedures) demonstrate that there is evidence that implicit measures of attitudes predict impulsive, but not controlled behavior, and with explicit measures the situation is vice versa, which can be applied in the analysis of the strength of impulses in consumer behavior and similar studies. In all three studies, respondents were randomly assigned to the experimental or control group. The respondents gave their informed consent and the ethical principles of conducting research were followed (debriefing was also done). The research procedure is described in detail and the discussion of the results takes into account the results of previous research, limitations and theoretical and practical contributions.

The eighth paper on the list in Table 1 (Petty et al., 2006) empirically re-examines the traditional attitude change model which assumes that when people appear to have altered their attitudes in response to new information, their old attitudes disappear and no longer have any effect. This research suggests that when attitudes change, the old attitude can remain in memory and influence behavior subsequently. The research consisted of four experimental studies in which initial attitudes were created and then changed (or not) by new information. In each study, the authors show that when people undergo attitude changes, their old and new attitudes can interact to produce evaluative responses consistent with a *state of implicit ambivalence*. The implicit measure of the IAT was used only in Study 2 (the experiment with a control group and an experimental group in which attitudes were changed, a complex design because the effect of a positive/negative "target" was also monitored). The results of Study 2 present that attitude change caused people to report less certainty on the implicit measure of attitudes (IAT) but not on the explicit one. The respondents gave their informed consent and the ethical principles of conducting research were followed. The research procedure, the statistical procedures used, results and implications are described in detail.

The ninth paper from the list in Table 1 (Rydell & McConnell, 2006) examines changes in implicit and explicit attitudes through five experiments. In the first experiment (complex between-subjects factorial design), the subjects were randomly assigned to 2 (valence of learned attitude: positive vs. negative) x 2 (level of reinforcement: 100%, 75%) x 2 (contrast information condition: control, vs. information that contradicts the attitude) groups. The attitude learning procedure and the way of applying the explicit and implicit (IAT) measure of attitudes are elucidated in detail. The results (obtained using adequate statistical procedures) imply that implicitly formed attitudes are not affected by the introduction of information that contradicts the attitude (explicit attitudes are affected), and that the slow-learning system is responsible for implicit attitudes, and the fast-learning system for explicit attitudes. The rest of the experiments are similar in design to the first one with minor changes. In the second experiment, certain subjects were given significantly higher levels of information which is opposed to the formed attitude in order to test whether they change then. At this point, respondents were randomly assigned to 2 (valence) x 2 (level of support) x 3 (counter-attitude information condition: control, 20 counter-attitude information, 100 counter-attitude information) groups. With a greater number of pieces of contrasting information, implicit attitudes also change, which suggests different mechanisms underlying implicit and explicit attitudes. In the third 2x2x3 factorial experiment, the first impression variable (true/false) was introduced instead of the attitude valence variable; in the fourth experiment, a complex experimental design of 1 (valence positive) x 1 (conditioning 100) x 2 (counter-attitude 0, toward 20) was used. As for the previous ones, the alterations in the design of the fifth experiment are described in detail. The results are adequately presented and discussed, pointing out possible problems and the ways for further research. There is no explicit information about informing and possible debriefing of respondents, although considering the requirements of the journal in which the paper was published, we assume that the paper adhered to ethical standards.

The tenth paper on the list in Table 1 (Perugini, 2005) tests predictive models of implicit (measured via computerized IAT) and explicit attitudes (questionnaire) – how well they predict behavior, through two studies. The first quasi-experimental study is about smoking behavior and provides confirmation for the multiplicative prediction model (implicit and explicit attitudes interact in the prediction of behavior). The second experimental study deals with preferences for snacks over fruit and supports the double dissociation model (implicit attitudes predict spontaneous behavior and explicit attitudes predict intentional behavior). In this study, the order of the instruments was counterbalanced, as was the order of the third and fifth steps in the IAT. In both studies, subjects were individually asked for their consent to participate in the experiment and it is stated that debriefing was done. The predictive validity of implicit attitudes was confirmed through two studies. The results are discussed in light of the importance of focusing on different patterns of prediction when investigating the directive influence of implicit and explicit attitudes on behavior. The authors also mention the limitations of the study and propose testing the models on other types of behavior and with other instruments.

Research on implicit attitudes contains the assumption that respondents cannot control their responses on implicit measures, but this was not explicitly verified in studies prior to Kim's (2003) study. The eleventh paper on the list in Table 1 examines the possibility of volitional control of the IAT, investigating in two experiments the ability of subjects to intentionally misrepresent their attitudes by using three different IAT measures. In the first experiment (group design with a control group and pre- and post-treatment observation), subjects were randomly assigned to a group that should give false answers about attitudes (experimental) and to a group (control) that gives spontaneous answers. There were no statistically significant differences between the groups, which indicates that subjects in the experimental group could not intentionally suppress their true attitudes. The second study is similar to the first one except that the topic is racial bias and that it is a quasi-experiment (division into groups according to their identification, white or Asian), and then by randomizing the division into three groups with regard to experimental conditions (control, false attitudes with the strategy of lying, false attitudes without a strategy). The group with the instructed strategy for false attitudes differs from the others.

In the twelfth study from the list in Table 1 (Van den Bergh et al., 2010), in the context of educating students belonging to ethnic minorities, it was examined whether the prejudices of teachers are reflected in their expectations toward students, as well as the academic achievement of their students. Prejudicial attitudes of elementary school teachers were assessed by using a self-report questionnaire and the Implicit Association Test (measured at school by means of a laptop computer in five blocks). Teachers' expectations were assessed through self-assessment questionnaires, and student achievement through the scores of the most recent standardized tests in text comprehension and mathematics. The results were processed by employing Multilevel Models constructed using MLwiN 2.02 (Rasbash et al., 2004, according to Van den Bergh et al., 2010) with variables at the student and teacher levels. The measures of attitudes/prejudices obtained by the self-assessment questionnaire do not achieve any effects, while it was determined that the attitudes - prejudices of teachers measured by means of the IAT elucidate different sizes of the gap in the achievement of different ethnic groups through the teachers' expectations. The results of this study imply that the use of measures of implicit attitudes may be important in educational research. All the research elements are explained in detail and critically reviewed with the awareness of limitations. For instance, not all variables of possible influence were controlled, the sample was composed through a public call on the website of the schools of the south-eastern part of the Netherlands and the respondents applied on a voluntary basis (bias sample selection), after which they were contacted and the research procedure was carried out.

Discussion and conclusion

The sources of implicit attitude measurement that are considered in this systematic review are mainly empirical papers in scientific journals, then review

papers in scientific journals, as scientific monographs, or their chapters. The reviewed papers were predominantly published in scientific journals with a high impact factor, primarily from the SSCI list, in which papers go through the process of (anonymous) peer review by other experts in the field, which is in line with the first proposed evaluating criterion.

A review of the available literature provides insight into the fact that research in this subfield is written in the form of scientific articles (abstract, introduction, method, results, discussion, and references). The method of presenting the instruments used, the sample, the method of sampling, as well as the method of data analysis, are clearly stated and it enables repetition of the research (second proposed evaluating criterion). Appropriate currently available statistical techniques were employed in the analysis of the results. In each research, the authors clearly indicated the shortcomings of the research itself. Thus, the illustrated papers are an example of the fact that the assumptions on which measures of implicit attitudes are based are verifiable (can be empirically confirmed or refuted), that the researchers' attitude is critical, that the empirical data were obtained through systematic and controlled procedures, and that the conclusions are based on the data (the second, third and fifth proposed evaluating criterion). Also, the authors of the above-analyzed studies adhered to ethical principles of conducting research (e.g., informed consent, debriefing) which is also an indicator of good scientific practice.

The measures they use do not always have the recommended levels of metric characteristics, but in a large number of cases they are at an acceptable level, there is evidence of adequate reliability, internal consistency, convergent validity, internal validity and predictive ability. The fact that the authors of implicit attitude studies compare these measures with explicit attitude measures, that they check the reliability and validity of their measures, that they verify the measure (IAT) in different contexts and with different stimuli, that they strive to improve them, supports the fact that they are aware of the importance of checking psychometric properties of implicit measures and that they do not operate in some isolated "alternate reality" (the third, fourth and fifth proposed evaluating criterion).

The definitions of terms are clear, although the studied construct belongs to the category of hypothetical constructs rather than intervening variables. Although an operational definition is being sought (intensity of association between a target-concept discrimination and an attribute dimension is assessed through response time measurement), it is still not completely possible for a wide range of constructs, and therefore there are problems in the domain of construct validity. However, the general approach is not common sense, the observation is not unrestricted, the reporting is not subjective and uncritical, although there are doubts about the exact definition of the term, the definitions are not vague, and the aim is to specify the domain of the studied construct (the fourth and fifth proposed evaluating criterion).

Part of the limitation of the reviewed research lies in the selection of samples on which the empirical verification of the construct is performed - it is mainly the student population (often they are researchers' students in an introductory course in psychology at a given university, mostly from the USA/Western Europe).

Therefore, the samples in these research studies are for the most part convenient, which raises the question of the representativeness of the samples themselves, i.e., the ecological validity of the research. However, this is a frequent case and practice in the scientific production in the field of psychological/social sciences. Moreover, it would be desirable if the samples were larger, but this is challenging given mostly the experimental study design.

Bearing in mind the proposed demarcation criteria, all of the above supports the fact that the measurement of implicit attitudes belongs to the domain of good scientific production, and not to the domain of pseudoscientific and common-sense thinking. Namely, pseudo-scientific production is characterized by the presentation of procedures and results in an insufficiently clear manner in publications intended primarily for the general non-expert public, while shortcomings are ignored and hidden (Hedrih & Hedrih, 2022), which is not the case here. The enumerated limitations and shortcomings of researching implicit attitude measurement are similar to those in other research in the field of social sciences, as well as the positive sides and achieved methodological standards. The level of knowledge and research on the measurement of implicit attitudes requires more empirical verification in different contexts both in terms of reliability and in terms of different aspects of validity. A theoretical clarification of the scope of this term and a clearer differentiation from related constructs are needed.

Limitations

The limitations of this systematic literature review may stem from the very method of literature review and the applied inclusion and exclusion criteria. Namely, we commenced with a very broad search, and the outcome would probably have been different if the search had been focused from the beginning within one of the subfields of the researched phenomenon. The fact that the most important sources, which have been cited hundreds of times, have been selected may suggest the possibility that the better papers in the field that have withstood the judgment of scientific criticism have been considered, and that examples of not so good research practice have not even been found, if such exist. However, citations can stem not only from scientific recognition, but also from contestation, but the nature of citations was not the subject of this paper. The analysis includes papers from a relatively small number of journals and by a relatively small group of authors, mostly from the first ten years of the inclusion criteria, which may be an illustration of the actual situation, but also the bias of the search method. By defining the search to include papers in English, published in scientific journals in electronic form, this analysis does not include results published in books, dissertations, proceedings and conference abstracts, as well as unpublished papers. The potential advantage of this paper is that the area of measuring implicit attitudes has been narrowed down to one instrument that has proven to be the most popular, which makes the results more easily comparable and it is more undemanding to draw unequivocal conclusions. Moreover, this instrument

was established a couple of years (1998) before the defined date for study inclusion (year 2000), and it covered the entire scope of the search.

Considering the above-mentioned limitations, it is recommended, for future analyses of this type, to search for the units of analysis through several services for searching scientific production, and it would be useful to redefine the inclusion and exclusion criteria in order to make the study more comprehensive. Despite the aforementioned limitations and the fact that the results should be taken with reservations and that they do not apply to the entire range of implicit attitude measures, the established findings may be of use to researchers in this area.

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Metodološka korektnost istraživanja u merenju implicitnih stavova: sistematski pregled

Mila Guberinić
Departman za psihologiju, Filozofski fakultet, Univerzitet u Nišu, Srbija

Apstrakt

Implicitne mere stavova daju procenu stavova koje ispitanici ne žele da izraze ili kojih možda nisu svesni. Ovaj rad predstavlja sistematski pregled naučne literature iz oblasti merenja implicitnih stavova, u kome se sagledava trenutno stanje i položaj ovog konstrukta sa ciljem ocene ispunjenosti naučno-metodoloških kriterijuma usvajanja znanja. Empirijski materijali su dobijeni u februaru 2023. preko sledećih pretraživača i platformi: Google, Google Scholar, SAGE, APA PsicNet, EBSCO, Science Direct, Research Gate i JSTOR. Kriterijumi za uključivanje: rad objavljen u naučnom časopisu, na engleskom jeziku, dostupan u celini u elektronskom obliku, iz oblasti psihologije/društvenih nauka, objavljen od 2000. godine do dana pretrage. U većini pregledanih izvora korišćen je/analiziran instrument Implicit Association Test (IAT), pa je ovaj podatak naknadno dodat kao kriterijum za uključivanje radova. Konačan broj studija za analizu bio je 22 - pet preglednih i 17 istraživačkih radova, uglavnom eksperimentalnih studija. Radovi su objavljeni u naučnim časopisima sa visokim impakt faktorom, pisani u IMRAD formatu, korišćene metode su adekvatno prezentovane, korišćeni su sistematski kontrolisani istraživački postupci i odgovarajuće statističke tehnike, zaključci su zasnovani na podacima i prisutan je kritički stav istraživača. Metrijske karakteristike korišćenog instrumenta su generalno na prihvatljivom nivou

– adekvatna unutrašnja konzistentnost, pouzdanost, konvergentna i interna validnost, prediktivna sposobnost, ali postoje problemi u domenu konstruktivne i ekološke validnosti.

Ključne reči: implicitni stavovi, mere, sistematski pregled, IAT

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