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'Going implicit': Using implicit measures in organizations*

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Impliciete tests winnen aan populariteit binnen de arbeids- en organisatiepsychologie. Ondanks deze groeiende populariteit is nog relatief weinig bekend over de verschillende soorten impliciete tests, de constructen die ermee gemeten worden en de mate waarin ze relevant gedrag in organisaties voorspellen. In dit artikel bespreken we eerst wat impliciete processen zijn op basis van de duale procestheorie. Vervolgens bespreken we de drie meest populaire impliciete tests, namelijk de Implicit Association Test (impliciete associatietest), Picture Story Exercise (plaatjes-verhaalttest) en Conditional Reasoning Test (conditionele redeneertest). Voor elke test beschrijven we de opzet, psychometrische eigenschappen (de betrouwbaarheid, construct- en criteriumgerelateerde validiteit), waargenomen (procedurele) rechtvaardigheid, praktische bruikbaarheid en de mate waarin deze impliciete tests gevoelig zijn voor 'test faking'. Op basis van de best beschikbare empirische evidentie stellen we voor hoe impliciete tests ingezet kunnen worden in organisaties. We bespreken ook welk toekomstig onderzoek hiervoor nodig is. Op deze manier hopen we een waardevolle bijdrage te bieden aan dit groeiende onderzoeksdomein binnen de arbeids- en organisatiepsychologie.

1 Introduction

Implicit measures have received much attention in the recent scientific and popular press (e.g., Sackett, Lievens, Van Iddekinge & Kuncel, 2017; Yen, Durrheim & Tafarodi, 2018). Especially over the past two decades, active research, increasing publications, and interdisciplinary cross-talk on implicit measures have evoked scholarly conversations about the usefulness of such measures (Zedeck, 2017). However, despite their increasing popularity, questions remain about various

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aspects of implicit measures, such as why implicit assessment is important, the types of implicit measures that can be distinguished, which constructs are operationalized with implicit tests, and how these tests can be applied in practice. Each of these aspects is introduced briefly and explained in the remainder of this article. Therefore, this article is focused on making implicit measures more explicit, especially for organizational researchers and practitioners. First, by looking at *why* implicit assessment might be important, we start with outlining the theoretical foundations of implicit assessments, given that dual-processing theory has the potential to provide novel insights into issues and practices related to organizational behavior. Second, our study sheds some light on *which* type of implicit tests can be distinguished, and *how* constructs are operationalized. By giving an integrated overview of the currently available paradigms on implicit measures, we broaden the taxonomy presented by Uhlmann et al. (2012). Specifically, whereas the classification of Uhlmann et al. (2012) addresses *which* specific implicit content is tapped, our taxonomy addresses *how* implicit content is captured. In doing so, we add 26 measures to the implicit 'toolbox'. We then illustrate and discuss in-depth prevalent exemplars, namely the Implicit Association Test (IAT), the Picture Story Exercise (PSE), and the Conditional Reasoning Test (CRT). Third, for operational utility in organizations, implicit measures must meet stringent criteria (e.g., reliability, validity, fairness; American Educational Research Association (AERA), American Psychological Association (APA) & National Council on Measurement in Education (NCME), 2014; Evers, Sijtsma, Lucassen & Meijer, 2010) just like traditional assessment measures (e.g., cognitive ability tests, interviews). Therefore, to assess whether implicit measures are reliable and valid, we considered each exemplar against the following criteria that are also used by the COTAN (Commissie Testaangelegenheden Nederland): psychometric properties (reliability, construct and criterion validity), perceptions of fairness and procedural justice, and faking potential. By weighing the evidence on each of these criteria, our study provides a timely contribution to practitioners who are considering adopting implicit measures in their organizations. Finally, we provide recommendations for practice and future research on how to improve validation and future utilization of implicit measures in organizations.

2 Dual processing and implicit measures

Across cognitive and social psychology domains, there is a vast amount of research suggesting that social cognition, reasoning, judgement and even personality emanate from a dual process.¹ For instance, psychologists have relied on the dual-process system for a better understanding of personality (affective/cognitive system theory; Mischel & Shoda, 1995) and decision-making (thinking fast/thinking slow; Kahneman, 2003). Dual processing refers to 'the assumption by many theorists that cognitive tasks evoke two forms of processing that contribute to observed behavior' (Evans & Stanovich, 2013, p. 225). Today, growing evidence suggests that both a spontaneous (implicit) and a fully considered (explicit) cognition influence organizational behavior (Pratt & Crosina, 2016). Implicit cognition refers to the spontaneous activation of behavior, whilst explicit cognition denotes fully considered, controlled thoughts that require introspective awareness

about one's motives and attitudes. In particular, implicit measurement denotes assessing attitude, personality, and motives, which are inferred from indirectly examining results, based on spontaneous behavior, whereas explicit measurement refers to fully considered, self-report assessments (De Houwer & Moors, 2010). Meta-analytic research ($N = 36,071$; Kurdi et al., 2018) found that implicit cognition may influence fully considered cognition (explicit) and, in turn, predict behavior. As such, insight into both implicit and explicit cognition may be essential to understand or predict work-related behavior fully (Christiansen & Tett, 2013; Ortner & Van de Vijver, 2015). In fact, implicit measures have been applied to gain deeper insight into health-related behavior, consumer choices, political preferences, pathology and many other areas of psychology to evaluate attitudes, personality, stereotypes and prejudices (Hahn & Gawronski, 2015; Uhlmann et al., 2012). This explains why practitioners and researchers have shown interest in the potential usefulness of implicit measures in organizations (Lievens & De Soete, 2011). Next, we explain what implicit measures are and what they measure.

3 Implicit measures: Categories, exemplars and application

Overall, implicit measures can be categorized according to three broad psychological assessment techniques, namely evaluation by means of *automaticity*, *projection*, or *justification*. Whereas Appendix A outlines a taxonomy of implicit measures, listing 26 automaticity-, 20 projective-, and 3 justification-based tests, below we summarize the theoretical origins underlying each class.

3.1 Automaticity-based measures

Automaticity-based measures might be defined as tests that are used to assess respondents' instinctive reaction (by means of selection or physical responses to latent reaction-timed tasks) towards either multiple concepts (connected as part of a cognitive schema) or individual concepts to establish how target concepts are linked in stored memory (De Houwer, Teige-Mocigemba, Spruyt & Moors, 2009). According to Gawronski and De Houwer (2014), implicit tests based on *automaticity* originated from the theoretical work of Fazio, Sanbonmatsu, Powell and Kardes (1986) and Gaertner and McLaughlin (1983) who studied the automatic activation of attitudes and stereotypes. Automaticity-based measures typically assess the automatic activation of attitudes, stereotypes, and preferences. They can be subdivided into two types, based on the specific implicit content they capture, namely association-based measures (like the Implicit Association Test; Greenwald, McGhee & Schwartz, 1998) and accessibility-based measures (like the Modified Stroop Task; Mathews & MacLeod, 1985). *Association-based* measures refer to implicit tests that determine whether multiple target concepts are linked (e.g., for detecting racial bias towards White versus Black), whereas *accessibility-based* measures refer to implicit tests that assess spontaneously activated single-target concepts (e.g., detecting state anxiety). Of all automaticity-based tests, the Implicit Association Test (IAT) is by far the most popular (Gawronski & De Houwer, 2014), as judged by the number of citations.

The IAT has been used to measure various personality traits (De Cuyper et al., 2017), different forms of stereotypes (Jones et al., 2017) and work-related outcomes, such as driving or flight behavior (Bıçaksız, Harma, Doğruyol, Lajunen & Özkan, 2018). For example, the IAT-Racial Prejudice (Greenwald et al., 1998) is typically used to assess people’s racial prejudice by the association of two contrasting target concepts (e.g., pictures of White/Black faces) with an attribute (e.g., pleasant vs. unpleasant words). In short, racial prejudice can be detected through the difference in response time for pairs of target concepts and attributes that are paired with each other. A so-called ‘compatible block’ is found where pictures of White faces are paired with positive words such as *pleasant*, and Black faces are paired with negative words, such as *unpleasant*, or in the case of a pair of target concepts and attributes that seem incompatible with each other. This is the so-called ‘incompatible block’ of stimuli, such as when pictures of White faces are paired with negative words, such as *unpleasant* and Black faces are paired with positive words, such as *pleasant*. For individuals who favor White people over Black people, reaction times for the compatible block will be faster compared to the incompatible block, also known as the ‘IAT- effect’ (Greenwald et al., 1998). Thus, the IAT effect represents prejudice attitudes towards Black persons. Table 1 presents the IAT racial prejudice in a schematic way.

Table 1 *Schematic description and illustration of the Implicit Association Test designed to assess preferences for Whites over Blacks (IAT-Racial Prejudice; Greenwald, McGhee & Schwartz, 1998, p. 1465)*

Sequence (Steps)	1	2	3	4	5
Task description	Initial target-concept discrimination	Associated attribute discrimination	Initial combined task	Reversed target-concept discrimination	Reversed combined task
Task instructions	• BLACK WHITE •	• Pleasant Unpleasant •	• BLACK • pleasant WHITE • Unpleasant •	BLACK • • WHITE	BLACK • • pleasant • WHITE unpleasant •
Sample stimuli	MEREDITH ○ ○ LATONYA ○ SHAVONN HEATHER ○ ○ TASHIKA KATIE ○ BETSY ○ ○ EBONY	○ lucky ○ honor poison ○ grief ○ ○ gift disaster ○ ○ happy hatred ○	○ JASMINE ○ pleasure PEGGY ○ evil ○ COLLEEN ○ ○ miracle ○ TEMEKA bomb ○	○ COURT-NEY ○ STEPHANIE SHEREEN ○ ○ SUE-ELLEN TIA ○ SHARISE ○ ○ MEGAN NICHELLE ○	○ peace LATISHA ○ filth ○ ○ LAUREN ○ rainbow SHANISE ○ accident ○ ○ NANCY
Blocks and trials	Practice block (20 trials)	Practice block (20 trials)	Practice block (20 trials) Test block (40 trials)	Practice block (20 trials)	Practice block (20 trials) Test block (40 trials)

Note. Categories for each of these discriminations are assigned to a left or right response key, indicated by the black circles. Stimuli for the tasks are indicated with correct responses, indicated as open circles.

The IAT procedure (Greenwald et al., 1998) is best applied in organizational settings to measure constructs such as attitudes (e.g., racial, gender, or weight prejudice; Agerström & Rooth, 2011), personality traits (e.g., assessing the Big Five traits, shyness, aggression, altruism) (De Cuyper et al., 2017; Vecchione et al., 2017), and achievement orientation (Dietl, Meurs & Blickle, 2017). IATs comprise both pictorial and textual stimuli (Nosek et al., 2007), which are easily changed. The typical IAT procedure consists of five sequential steps, in which 180 trials are presented in seven blocks (five practice blocks consisting of 20 trials each and two test blocks with 40 trials each). IATs are not specifically timed; however, data of respondents with 10% reaction times faster than 300 ms and fewer than 160 completed trials are considered erroneous and should not be included for interpretation. Furthermore, IATs can be administered successfully in a laboratory setting or online (Hilbig, 2015), both as a computerized or pencil-and-paper test (Lemm, Lane, Sattler, Khan & Nosek, 2008). Furthermore, Gawronski and De Houwer (2014) recommend easy, readily available instructions about IATs (Sekaquaptewa, Vargas & Von Hippel, 2010). Examples can be obtained easily online (e.g., at <http://www.millisecond.com/download/library/iat> or <http://www.projectimplicit.net>) and the way to score the IAT is thoroughly explained in Greenwald, Nosek and Banaji (2003).

3.2 Projection-based measures

Implicit cognition can also be assessed by means of projection-based measures, which can be defined as tests that require respondents to generate responses by using association, construction, completing, arrangement, and expression, which reveal aspects of their personality by disambiguating unstructured test stimuli (Lilienfeld, Wood & Garb, 2000). The development of projective measures can be traced back to the psychoanalytic theory of Sigmund Freud (Uhlmann et al., 2012). Projective techniques, originally developed for clinical screening, gauge implicit cognition based on how respondents describe graphic stimuli presented to them, and are categorized according to five types, depending on how implicit content is captured (Lindzey, 1959): creating a story (construction), responding with the first word that comes to mind (association), arranging stimuli (arrangement), completing unfinished words or sentences (completion), or expressing oneself.

According to Carter, Daniels and Zickar (2013), Thematic Apperception Tests (TAT; Morgan & Murray, 1935) are mostly used in organizational settings. What was originally termed 'the TAT' was later (synonymously) referred to as the 'Picture Story Exercise' (PSE) (Chasiotis, 2015; Slabbinck et al., 2018). Although there are various construction-type tests (as given in Appendix A), we will explain the PSE, which is said to be the oldest, most valid and most popular approach to assess implicit motives, such as achievement orientation, need for power, or fear of failure (McClelland, Koestner & Weinberger, 1989; Schüler, Brandstätter, Wegner & Baumann, 2015; Schultheiss & Pang, 2007).

The PSE is founded on the motive theory of Morgan and Murray (1935), and is based on the psychoanalytic principle of projection (simply stated as the cognitive bias of seeing one's own qualities in others; Baumeister, Dale & Sommer, 1998). Respondents view motivationally arousing images, displaying people in various social situations, and then they have to write stories (unrelated to themselves)

about the pictorial stimuli (Schüler et al., 2015). Trained psychologists then use the empirically derived, psychometrically validated, running text scoring manual (Winter, 1994) to evaluate responses.



In the instructions, there are some guiding questions, for example:

- a) What is happening?
- b) Who are the people?
- c) What happened before?
- d) What are the people thinking about and feeling?
- e) What do they want?
- f) What will happen next?

However, these questions only guide the test-taker to invent his or her own story and the test-taker does not have to answer the questions specifically. Test-takers should write whatever story comes to their mind in the space provided.

Figure 1 Example of Picture Story Exercise image to assess the need for power (Schüler et al., 2015)

Figure 1 illustrates an example of the PSE, which is typically used to capture individuals' implicit needs (e.g., achievement, power, affiliation, fear; Hofer & Busch, 2011), and may affect long-term organizational outcomes, such as wellbeing (McClelland et al., 1989). PSEs normally consist of four to eight pictures, since too few pictures may result in reduced variance and too many pictures may decrease test validity due to fatigue (Schultheiss & Pang, 2007). Each picture is presented for 10-15 seconds, and respondents then construct imaginative stories with some guiding questions included in the instructions. Respondents usually have five minutes to write one story; however, test time could be adjusted or untimed. Each motive (e.g., achievement, power, affiliation) has a different coding system, with differing subcategories. Typically, experienced coders need about 16-40 hours to score a six-image PSE for 80 people (Schultheiss & Pang, 2007).

Step-by-step, detailed instructions on how to conduct and score a PSE can be found in numerous sources (Smith, 1992; Winter, 1994). The PSE can be administered both online (see <http://www.millisecond.com/download/library/picturestoryexercise>) or in a laboratory setting (Bernecker & Job, 2010). The computerized PSE shows advantages over the pencil-and-paper format: instructions are standardized, respondents complete the test on their own, which minimizes experimenter effects, and typed stories tend to be longer by more than one third; thus, providing more scorable information. Scoring time is also considerably reduced, because transcribing for electronic analyses and archiving is eliminated (Schultheiss, Liening & Schad, 2008).

3.3 *Justification-based measures*

Finally, implicit cognition can also be captured through justification-based measures, which can be defined as tests that use scenarios or situations to assess what a test respondent thinks is a reasonable way to act. Implicit tests, using justification as means of assessment, work on the assumption that individuals will project their own worldview on situations offered by making judgments that support it. Rationalization, which stems from psychoanalytic theory, refers to justification mechanisms (a specific facet of defense mechanisms), which implicitly shape one's judgement towards the outer world, justifying behavior by substituting acceptable reasons for real motives (such as aggression, achievement orientation, fear of failure, etc.). Thus, mechanisms of justification are used to enhance the rational appeal of behavior; for example, aggressive people might express a desire to inflict harm on others (James, McIntyre, Glisson, Bowler & Mitchell, 2004).

The Conditional Reasoning Test (CRT; James, 1998) is considered 'the groundbreaking method of implicit personality assessment by the American Psychological Association' (Galić, 2016, p. 24). Various researchers have pointed out that the CRT shows the most potential for measuring organization-related criteria, because it is scored quantitatively and thus considered to be more objective than other related measures (Christiansen & Tett, 2013; Uhlmann et al., 2012). The CRT is based on the notion that people with a strong desire to engage in behavior will develop biased ways of reasoning to make the behavior seem rational (e.g., individuals with underlying aggression will find ways to justify why they engage in counterproductive behavior at work).

The Conditional Reasoning Test (CRT; James, 1998) is presented as a test of logical reasoning ability, consisting of various inductive reasoning problems to be solved. However, these measures tap into respondents' underlying needs and motives, such as achievement motivation or underlying aggression. Building on the theory of McClelland et al. (1989), CRTs are based on the idea that the cognitive reasoning process may reflect individuals' underlying psychological motives. Motives (such as achievement) are further considered to be linked to different cognitive biases, called 'justification mechanisms' (James et al., 2004). Justification mechanisms influence one's reasoning and enhance the rational appeal of behaving in a manner consistent with latent motives (see James & LeBreton, 2012). Therefore, CRTs use reasoning problems to elicit implicit biases that justify a certain behavior (like counterproductive work behavior; James et al., 2004). The term 'conditional' refers to the reasoning that is dependent on the latent motive of the individual and how he or she justifies behavior. An aggressive versus a socially adaptive respondent will differ in how he or she judges behavior to be rational; thus, selecting a response most suited in justifying what he or she thinks is reasonable behavior. Although the CRT can be used to capture various constructs, the most published research is on the CRT for aggression (CRT-A test manual; James & McIntyre, 2000), and this measure consequently best illustrates how defense mechanisms function, as illustrated below.

Table 2 *Illustrative conditioning reasoning problem for measuring aggression in the Conditional Reasoning Test (James & McIntyre, 2000)*

Question: The old saying, an eye for an eye, means that if someone hurts you, then you should hurt that person back. If you are hit, then you should hit back. If someone burns your house, then you should burn that person's house. Which of the following is the biggest problem with the eye for an eye plan?

- a) *people have to wait until they are attacked before they can strike (aggressive response)*
 - b) *it offers no way to settle a conflict in a friendly manner (non-aggressive response)*
 - c) *it tells people to turn the other cheek (distractor option)*
 - d) *it can be used only at certain times of the year (distractor option)*
-

The CRT is best used in organizations to measure aggression (Galić, 2016), achievement orientation and creativity (Schoen, Bowler & Schilpzand, 2018), which determine work-related behavior, such as counterproductivity and job performance. In terms of the CRT test material, these tests are easily administered in pencil-and-paper or computerized format (James & LeBreton, 2012). The CRT-Aggression, for instance, has 25 items, with four response options (as illustrated in Table 2), and has a 25-minute time limit. The first three test items are actual inductive reasoning problems, influencing respondents to believe that it is a test of logical reasoning. The remaining 22 conditional reasoning items are designed to reveal justification mechanisms associated with aggression. Within the response options, one justification mechanism is related to possible aggressive behavior (scored +1) and one to a non-aggressive response (based on prosocial counterparts to aggression, scored -1). Moreover, there are also two illogical distractor options (each scored 0), which add to the face validity of the CRT. Scores are added, ranging between 0 and 22, where respondents scoring high (≥ 8) are likely to act aggressively, because they have mechanisms in place to justify aggressive behavior (James & LeBreton, 2010). When participants select five or more illogical options, their score is considered invalid (James & McIntyre, 2000).

4 Evaluating implicit measures

An important matter to consider is whether implicit measures can be securely incorporated into organizational settings (Christiansen & Tett, 2013). One way to address this is to appraise the psychometric properties of implicit measures to determine whether they adhere to the minimum measurement requirements (e.g., the Dutch Rating System for quality assessments; Evers, 2001). Thus, we assessed the reliability, construct and criterion validity, perceptions of fairness, procedural justice, and faking potential of the IAT, PSE and CRT.

4.1 Reliability and validity

First, when determining construct validity (i.e., correlating implicit and explicit test scores from measures assessing the same construct), one would expect these scores to be highly related. However, this is not the case for implicit measures,

since meta-analyses show that, on average, implicit-explicit counterparts correlate close to $r = .25$ for automaticity-based tests (Greenwald, Banaji & Nosek, 2015), $\rho = .13$ for projective-based tests (Köllner & Schultheiss, 2014), while justification-based tests rarely exceed $r = .30$ (James & McIntyre, 2000). This small to moderate implicit-explicit intercorrelation paradox commonly found is also referred to as the 'heteromethod convergence problem' (Bornstein, 2002, p. 48). Some researchers (e.g., McClelland et al., 1989; Nosek & Smyth, 2007) are of the opinion that implicit and explicit cognitions stem from different underlying cognitive processes and that self-report measures are not the 'golden standard' to determine the construct validity of implicit measures (Carter et al., 2013). In Table 3, we provide general reliability and validity estimates of the IAT, PSE and CRT, which might be compared to the standard reliability and validity estimates that are deemed adequate (i.e., according to the Dutch Rating System for quality assessment; Evers, Lucassen, Meijer & Sijtsma, 2009; Evers et al., 2010).

It is, however, remarkable that, although some reliability and validity estimates of implicit measures do not conform to the required standards, as stipulated by the Dutch Rating System, there is adequate evidence of criterion-related validity for automaticity-, projective-, and justification-based tests, respectively ($r \geq .20$ as seen in Table 3). Showing adequate criterion-related validity, whilst still determining construct validity, is not unusual for novel assessment techniques, since this seems to be part of the natural evolution of assessment research (e.g., situational judgement test; Whetzel & Reeder, 2016). Granting that some aspects of reliability and validity of implicit measures remain disconcerting (i.e., evaluated against acceptable estimates presented in Table 3), current validation processes need improvement (Perugini, Richetin & Costantini, 2018).

4.2 Fairness perceptions

In deciding whether to utilize tests for organizational practices, the way test-takers perceive these tests (i.e., showing fairness and procedural justice) is important, given that test-taker reactions have considerable organizational consequences (e.g., turnover, test performance, perception of organizational attractiveness; McCarthy et al., 2017). When participants were asked whether the automaticity-based IAT (developed to predict training skills) could be used as a test for hiring or promoting individuals, they felt that the IAT shows a lack of procedural justice (Wright & Meade, 2011).

In terms of projective tests, the pictures used in exercises can elicit different motives for respondents from different cultural, gender or educational backgrounds (Drescher & Schultheiss, 2016; Runge, Lang, Chasiotis & Hofer, 2018). The lack of face validity, potential cultural biases, and possible adverse impact may lead to a decreased acceptance of these assessment measures by test-takers (e.g., job applicants). Additionally, individuals may respond defensively towards implicit score feedback (e.g., implying prejudice), because people generally believe that they are less biased than their implicit test results reveal (Howell, Redford, Pogue & Ratliff, 2017; Yen et al., 2018). The perception of unfair assessment could

Table 3 Psychometric properties of the IAT, PSE and CRT evaluated against the criteria of being adequate/acceptable according to the Dutch Rating System (Evers et al., 2009; Evers et al., 2010)

Properties of reliability/validity (acceptable estimates)	IAT ^a	PSE ^b	CRT ^c
Internal consistency (.70 ≤ r < .80)	r = .70 to .90 (Gawronski & De Houwer, 2014).	r = .10 to .40 However, internal consistency is not adequate to determine reliability (Lang, 2014).	r = .76 (James et al., 2004).
Interrater reliability (.60 ≤ r < .70)	N/A	r = .70 to .87 (Schüler et al., 2015; Schultheiss et al., 2008).	N/A
Retest reliability (.60 ≤ r < .70)	r = .54 (Gawronski, Morrison, Phills & Galdi, 2017).	Measured after a day, r = .70 a week, r = .60 a month, r = .52 one year, r = .37 (Schultheiss & Pang, 2007).	r = .82 Hybrid alternative form reliability (James et al., 2005).
Convergent validity (.55 ≤ r < .65)	r = .17 to .48 Depending on criterion measured (Bar-Anan & Nosek, 2014; Greenwald, Poehlman, Uhlmann & Banaji, 2009). Averages around r = .25 (Gawronski & Hahn, 2017; Greenwald et al., 2015).	Often low or even insignificant (Schüler et al., 2015). Meta-analyses: findings: for motives on affiliation ρ = .12, achievement ρ = .14, power ρ = .04 and for the overall relationship ρ = .13 (Köllner & Schultheiss, 2014).	Often unrelated and rarely exceeds r = .30 (Galić et al., 2014; James & LeBreton, 2012; James & McIntyre, 2000).

<p>Criterion-related validity (.20 ≤ r < .35)</p>	<p>Meta-analyses: findings for intergroup behavior range from $r = .02$ to $.37$ (Kurdi et al., 2018). Meta-analyses: Personality (Big Five traits, shyness, aggression, altruism) ranges from $r = .13$ to $.25$ (De Cuyper et al., 2017). Meta-analysis: IAT scores associated with opposition to diversity policies, IAT measures were associated with opposition to diversity policies ($\bar{r} = .20$ [95% CI = .07, .22] (Jones et al., 2017). Meta-analyses: Black-White inter-racial stereotypes average around $r = .20$, predicting 4% of variance in discrimination-relevant criteria (Greenwald et al., 2015).</p>	<p>Meta-analyses: Achievement orientation predicts behavior (i.e., entrepreneurial career), $r = .20$ (Collins, Hanges & Locke, 2004).</p>	<p>Meta-analysis: CRT-Aggression predicts counterproductive work behavior, $r = .26$ (Berry, Sackett & Tobares, 2010). However, after controlling for publication bias, estimates may be adjusted downward, $r = .17$ (Banks, Kepes & McDaniel, 2012).</p>
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^a Implicit Association Test (IAT), ^b Picture Story Exercises (PSE) and ^c Conditional reasoning Test (CRT)

result in legal difficulties and ethical implications for organizations (Bing, LeBreton, Davison, Migetz & James, 2007).

In terms of justification-based CRTs, genuine inductive reasoning problems are included as items. These tests are therefore generally perceived as tests of cognitive ability. However, whether test-takers would see this as a fair assessment that demonstrates procedural justice (related to a particular job) is yet to be empirically determined (Ones, Anderson, Sinangil & Viswesvaran, 2017).

4.3 Faking potential

Despite test-taker reactions on fairness and procedural justice, studies have shown that it seems possible for people to fake automaticity-based tests, such as the IAT (Steffens, 2004). Feigning becomes probable when the purpose of the test is revealed, with increased experience or knowledge of the test, or when individuals are instructed to fake their responses (Hu, Rosenfeld & Bodenhausen, 2012). Specifically for projective tests, researchers have determined that it is more difficult to fake projective tests compared to self-report and semi-structured projective measures (Ziegler, Schmidt-Atzert, Buhner & Krumm, 2007). As in the case of automaticity-based tests, justification-based tests, such as the CRT, are also resistant to faking, but only until the construct being measured is revealed (Bowler & Bowler, 2014; LeBreton, Barksdale, Robin & James, 2007). Moreover, CRTs are susceptible to faking when items are too obvious, because respondents are then able to identify what the test is designed to measure and ultimately predict (e.g., as in the case of the CRT-Integrity designed to predict counterproductive behavior; Fine & Gottlieb-Litvin, 2013). Finally, once respondents know how CRTs work, 75% are able to 'fake good' (Wiita, Meyer, Kelly & Collins, 2017).

5 Suggestions to improve implicit measures in organizations

5.1 How to improve the validity of implicit measures

Our evaluation of implicit measures against industry standards for psychological measures shows these measures fall short in many areas. Establishing validity is an unitary approach (Binning & Barrett, 1989) where validity includes the full range of validity 'types' (content-, construct-, and criterion-related validity). Therefore, considering acknowledged validation approaches (Cronbach & Meehl, 1955), we provide a few suggestions.

First, from the onset of implicit test development, stimuli should be theory based and pilot tested (i.e., conceptually equivalent to the explicit construct measured; De Cuyper et al., 2017). Second, and in line with measurement equivalence studies (Morelli, Potosky, Arthur & Tippins, 2017), constructs should be assessed using different means (i.e., using different technologies, such as pencil-and-paper versus electronic tests, also using tests based on different techniques, for example an IAT, CRT and PSE to measure the construct of interest). Third, higher covariance between implicit measures can only be expected when the reliability of the tests is first accounted for. Some ideas to increase reliability (e.g., temporal fluctuation of the IAT) could be to contextualize implicit cues or stimuli to make implicit

attitudes less malleable (Gschwendner, Hofmann & Schmitt, 2008). In terms of the PSE, internal consistency estimates (i.e., correlating scores from different stories within a PSE) are not suited to establish reliability (Atkinson, Bongort & Price, 1977), since different motives are triggered during the test, forcing participants to react differently to items (Bernecker & Job, 2010), consequently resulting in low estimates. To prove reliability, one can apply the Thurstonian item response theory to demonstrate that the PSE provides meaningful measures of separate constructs in a response pattern (Lang, 2014).

Fourth, to gain insight into the implicit-explicit realm, the construct-method distinction approach (multitrait-multimethod framework or MMTF; Campbell & Fiske, 1959) is recommended; thus demonstrating simultaneous evidence of convergent and discriminant validity, proving that implicit-explicit attitudes are related and distinct and not accounted for by method factors (Nosek & Smyth, 2007). For instance, Slabbinck, De Houwer and Van Kenhove (2013) compared the criterion-related validity of an IAT and a PSE, keeping the construct (power motive) constant. In doing so, the authors determined that the IAT and PSE methods are related, but distinct. Unfortunately, multiple motives (e.g., including achievement and affiliation) were not assessed; hence, differentiation between method and construct cannot be accounted for. In line with these authors, Arthur and Villado (2008) highlight the importance of the construct-method distinction for validating measures, such as implicit tests. In doing so, an evidence-based approach should be followed, clearly distinguishing between predictor construct (i.e., behavioral domain being sampled) and predictor method (i.e., the process by which the behavioral domain is measured) because, when construct and method are confounded, one cannot determine whether observed effects are due to *what* is measured or *how* it is measured. On discovering construct irrelevant variance due to implicit methods, the fundamental question would then be (Morelli et al., 2017): what are the theoretical reasons for construct irrelevant variance? Further research then needs to be undertaken to answer this question.

Fifth, we recommend following a construct-oriented methodology, which is scientifically aligned with organizational research and practice (Wernimont & Campbell, 1968). Thus, from the outset, implicit measures should be aligned to assess fine-grained facets or dimensions of work performance criteria (e.g., annual performance appraisal ratings). In general, we agree that findings on actual work-related behavior appear to be thinly spread in current literature (Ones et al., 2017), since most criterion-related validities are reported within the personality or social psychology domains. Thus, more studies are needed where actual criterion-related validity estimates are reported for specific contextual work-related outcomes. Additionally, since implicit cognition refers to the spontaneous activation of behavior (De Houwer & Moors, 2010), when establishing validity, assessment techniques that are more closely related to actual behavior, such as gamified assessments, assessment centers, work samples, in-baskets, situational judgment tests, and previous work history, should perhaps be considered. Finally, behavior-based observer reports (e.g., by peers or supervisors) should also be included in the validation process, since (non-significant) findings may also reveal important information about implicit behavioral relationships and whether mod-

erating variables are involved (e.g., whether implicit aggression predicts counterproductive work behavior depends on self-control; Galić & Ružojčić, 2017).

5.2 Thoughts to consider before applying implicit measures

Our evaluation of implicit measures showed that these tests could potentially be useful to predict various criteria, since they are more difficult to fake. However, in the light of the empirical evidence presented, we urge practitioners to consider using implicit measures with caution. Since implicit tests are often used to measure underlying cognition of which people may be ignorant (e.g., racial bias), test-takers may react defensively when test results are given. Furthermore, in some countries, the use of psychometric tests for selection purposes is legally governed; therefore, some implicit tests may only be administered and scored by trained psychologists. Additionally, some evidence suggests that implicit cognition may differ across groups (Drescher & Schultheiss, 2016; Runge et al., 2018). Thus, the perception of ethnicity-based adverse impact against protected groups may lead to legal and ethical implications (McCarthy et al., 2017). Therefore, to advance the notion of implicit testing in organizations, more empirical evidence is needed in terms of method bias (i.e., across various implicit tests), item bias (stimulus material within tests), adverse impact, determining norm groups, and defining cut scores (e.g., age, gender, ethnic group).

5.3 Which implicit test should organizations use?

Despite the caveats we have pointed out, the psychologist or practitioner considering including implicit tests for psychological assessment might question which type of measure (i.e., automaticity, projective, or justification based) is shown to be more useful. The answer to this question is complex and depends on what the assessment aims to achieve. For instance, where the IAT might be useful in predicting political preferences, consumer choices, prejudice behavior, and certain personality traits, such as extraversion or agreeableness (De Cuyper et al., 2017), the CRT may be better suited to identify counterproductive work behavior, especially amongst individuals with high levels of latent aggression (DeSimone & James, 2015). The PSE (and other projective construction-type tasks) may be more adequate to determine underlying needs and motives (e.g., power, achievement, affiliation, fear of failure, etc.).

In comparing the IAT, CRT and PSE, we found the theoretical basis and quality of test materials for each measure were well established. By opting to administer the respective tests electronically, higher reliability and validly estimates may result and scoring time may be faster (Schultheiss et al., 2008). However, coding the PSE may take longer (when compared to the IAT and CRT). It should also be noted that respondents should never be made aware of how a construct is measured (irrespective of the implicit test in use), since faking then becomes probable for the IAT, CRT and PSE respectively.

Whilst there are some concerns in terms of the reliability of the IAT and the PSE (i.e., temporal fluctuation and low internal consistency respectively), the CRT shows acceptable reliability estimates. However, the CRT is also not the panacea, since this test still raises some questions, such as whether certain constructs lend

themselves better to being measured with the CRT, and whether justification mechanisms are applied universally across different groups (Ones et al., 2017). Furthermore, although work has been done on the application of the CRT-A to predict aggression in diverse, 'normal' cultural groups (Galić, Scherer & LeBreton, 2014), the CRT-A seems better suited in identifying counterproductive behavior within individuals with high levels of latent aggression. Therefore, DeSimone and James (2015) recommend that, before applying this test in organizational settings, CRT items should also be able to discriminate amongst individuals with low levels of aggression. Additionally, literature on the criterion-related validity of CRTs to predict more specific facets of performance is lacking (Ones et al., 2017). Finally, in terms of construct validity, implicit-explicit covariance is found to be low for the IAT, CRT and PSE as illustrated in Table 3. However, despite low construct validity, all three tests have shown adequate estimates of criterion-related validity. Therefore, we cannot simply conclude that one implicit test is better than another, since it depends on the criteria one wishes to predict.

6 Implications for research

A remaining challenge for researchers is firstly to understand and confirm how implicit-explicit relations relate to predict criteria (James et al., 2005). Perugini, Richetin and Zogmaister (2010) illustrate examples where:

- implicit, but not explicit scores predict behavior (single association);
- implicit-explicit scores jointly predict behavior (channeling);
- implicit and explicit uniquely predict different behaviors (double dissociation);
- both implicit and explicit predict behavior under different conditions (moderation); and
- implicit-explicit scores interact to explain variance in criteria (multiplicative).

More recently, Kurdi et al. (2018) propose that implicit cognition may influence explicit cognition, which then drives behavior. Therefore, more research is needed on the boundary conditions of how implicit scores predict specific behavior.

Whilst some researchers have ascribed the poor psychometric properties of implicit measures to contamination or deficiency, others have started questioning whether these findings could perhaps be indicative of the low stability and variability within individual personalities (Fleeson & Law, 2015; Schultheiss et al., 2008). Where self-report personality tests gauge typical behavioral tendencies, not picking up the malleability of personality (Ferguson & Lievens, 2017), implicit tests could perhaps be revealing important information about within-individual personality plasticity in response to changing environments or contexts. Thus, whether low reliability and validity estimates of implicit tests are due to situation-specific, person-specific or method-specific factors also needs further investigation.

For psychologists and practitioners who wish to extend their methodologies on implicit measures applied in organizational contexts further, we provide a few priming ideas: automaticity-based measures, such as the IAT, show potential for

use as a clinical assessment tool. For example, bus and truck drivers, pilots or operators of heavy machinery (e.g., crane or forklift) can be screened for potential substance abuse, suicidal tendencies, driving skills, and risky flight behavior or aggressive driving behavior (Bıçaksız et al., 2018; Lindgren et al., 2018). Results could be combined with the current psychomotor tests used in practice (e.g., the Dover or Vienna Test System). Other automaticity measures (e.g., the Brief IAT) can be applied to measure achievement orientation, or to predict entrepreneurial activities. Also, picture-based projective tests have been found to predict organizational goal-setting and work performance (Hermans et al., 2017; Lang, Zettler, Ewen & Hülshager, 2012), the wellbeing of teachers (Wagner, Baumann & Hank, 2016), job satisfaction (Thielgen, Krumm, Rauschenbach & Hertel, 2015), and career planning (Ramsay, Pang, Ho & Chan, 2017). Further, psychological capital, an important construct related to central workplace outcomes (e.g., performance, citizenship behavior, turnover, etc.) can now be assessed by using the projective techniques (Harms, Krasikova & Luthans, 2018). In addition, the projective techniques (i.e., sentence completion) can be used to assess personality and aspects of marketing (Joy, 2017; Ridgeway, 2017).

Furthermore, implicit measures may be particularly useful for those areas of organizational behavior where human information processing and judgement are involved, and that are vulnerable to System I processing (such as cognitive heuristics and dual-processing theory). Deros, Buijsrogge, Roulin and Duyck (2016), for example, explain how recruiters' bias against stigmatized job applicants can be understood and studied from a dual-processing thinking perspective. Therefore, areas of implicit measurement application may include a broad range of human behavior in organizations (e.g., selection, assessment, creativity, entrepreneurship, leadership development).

Finally, we noted that implicit tests appear to be used most often for clinical psychological assessments in the United States and Canada (Piotrowski, 2017; Wright et al., 2017), where 49.3% of practicing psychologists report using performance-based projective tests for assessments. Further, roughly 60% of implicit measures have been developed in the United States (as illustrated in Appendix A). Countries where implicit measures are less frequently used include Belgium and the Netherlands (Muñiz et al., 2001; Piotrowski, 2015). We trust that this article will contribute to the application of implicit measurement and the dual-processing theory, especially in countries where these approaches appear to be less explored and underutilized.

7 Conclusion

In this review, we explored the potential usefulness of implicit measurement in organizational practice and research. To this end, our study sheds light on how these measures work, which constructs they assess, and how the validity of implicit measures could potentially be improved. In this way, we hope to contribute to a better understanding of implicit measures and their potential value for organizations. As a final thought, engaging in the implicit-explicit debate from the industrial-organisational psychology perspective may help us learn more about the underlying processes that drive behavior.

Practice Box

What do these findings mean for practice?

- There are three broad categories of implicit tests, each of which might be more appropriate to measure specific constructs in organizations. First, automaticity-based measures seem best suited to assess attitudes and preferences (e.g., political/consumer), interpersonal attitudes (related to age, race, gender and ethnicity), personality traits (especially extraversion and agreeableness), and perceptions about a group, person or the self (e.g., self-esteem, internal motives).
- Projection-based tests may be used for personal development (i.e., as part of work wellbeing programs) to establish, for example, goal setting, achievement orientation, career planning, wellbeing, job satisfaction and motives, such as the intention to quit.
- Justification-based tests can be used to detect undesirable behavior (such as aggression, low integrity or counterproductive work behavior), which is often difficult to measure with self-report tests, due to socially desirable responding. Moreover, desirable behavior, such as creative performance and achievement orientation, may be captured with implicit tests.
- The limited number of empirical studies show indications of poor psychometric properties of implicit measures; hence, results from implicit measures should be interpreted with this limitation in mind.

Note

- 1 Evans (2008) presents a generic dual-system theory under two main headings: System 1 (i.e., implicit, impulsive, reflexive, spontaneous) and System 2 (i.e., explicit, reflective, self-controlled, fully considered).

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Appendix A

Taxonomy of implicit tests grouped according to implicit assessment techniques.

Assessment Technique	Assessment Type	Implicit Test	Source
Automaticity: Defined as (computerized) tests which are used to assess respondents' instinctive reaction (by means of selection or physical responses to latent reaction-timed tasks), towards either multiple concepts (connected as part of a cognitive schema) or individual concepts to establish how target concepts are linked in stored memory (De Houwer, Teige-Mocigemba, Spruyt & Moors, 2009; Uhlmann et al. 2012).	Association	Implicit Association Test	Greenwald, McGhee and Schwartz (1998)
	Association	Recoding Free IAT	Rothermund, Teige-Mocigemba, Gast and Wentura (2009)
	Association	Go/No-Go Association Task	Nosek and Banaji (2001)
	Association	Implicit Association Procedure	Schnabel, Banse and Asendorpf (2006)
	Association	Implicit Relational Assessment Procedure	Barnes-Holmes et al. (2006)
	Association	Single Block IAT	Teige-Mocigemba, Klauer and Rothermund (2008)
	Association	Single-Target Implicit Association Test	Karpinski and Steinman (2006)
	Association	Breadth-based Adjective Rating Task	Karpinski, Steinberg, Versek and Alloy (2007)
	Association	Brief Implicit Association Test	Sriram and Greenwald (2009)
	Association	Evaluative Movement Assessment	Brendl, Markman and Messner (2005)
	Association	Affective Priming Task	Hermans, Houwer and Eelen (1994)
	Association	Shooter Task	Correll, Park, Judd and Wittenbrink (2002)
	Association	Name-Letter Effect	Nuttin (1985)
	Association	Sequential Evaluative Priming	Fazio, Sanbonmatsu, Powell and Karides (1986)

Assessment Technique	Assessment Type	Implicit Test	Source
<p>Projection: Defined as tests that require respondents to generate responses by using association, construction, completing, arrangement and expression, which reveal aspects of their personality by disambiguating unstructured test stimuli (Lilienfeld, Wood & Garb, 2000).</p>	Association	Subliminal Contact Priming	Dovidio, Kawakami, Johnson, Johnson and Howard (1997)
	Association	Affect Misattribution Procedure	Payne, Cheng, Govorun and Stewart (2005)
	Association	Extrinsic Affective Simon Test	De Houwer (2003)
	Association	Approach-Avoid Task	Rinck and Becker (2007)
	Association	Sorting Paired Features	Bar-Anan, Nosek and Vianello (2009)
	Association	Stereotypic Explanatory Bias	Sekaquaptewa, Espinoza, Thompson, Vargas and Von Hippel (2003)
	Accessibility	Modified Stroop Task	Mathews and MacLeod (1985)
	Accessibility	Lexical Decision Task	Wittenbrink, Judd and Park (1997)
	Accessibility	Stimulus Response Compatibility Task	Mogg, Bradley, Field and De Houwer (2003)
	Accessibility	Word Stem Completion Task	Grenard et al. (2008)
	Accessibility	Word Fragment Completion Task	Weiskrantz, Warrington, Sanders and Marshall (1974)
	Accessibility	Dot Probe Task	MacLeod, Mathews and Tata (1986)
	Construction	Thematic Apperception Test	Morgan and Murray (1935)
	Construction	Operant Motive Test	Kuhl and Scheffer (1999)
	Construction	Draw-a-Person Test	Machover (1949)
	Construction	House-Tree-Person Test	Buck (1948)
	Construction	Mirror Drawing Test	Brower (1948)
Completion	Sentence Completion Test	Loevinger (1976)	
Completion	Office of Strategic Services Sentence Completion Test	Murray and MacKinnon (1946)	
Completion	Personnel Reaction Blank	Gough (1971)	
Completion	Miner Sentence Completion Test	Miner (1978)	

Assessment Technique	Assessment Type	Implicit Test	Source
	Association	Rorschach Ink Blot Test	Rorschach (1912)
	Association	Cornell Word Form	Mittelman and Brodman (1946)
	Association	Implicit Positive and Negative Affect Test	Quirin, Kazén and Kuhl (2009)
	Association	Structured-Objective Rorschach Test	Stone (1958)
	Association	Perceptanalytic Executive Scale	Piotrowski and Rock (1963)
	Association	Rorschach Group and Multiple-Choice Test	Harrower-Erickson and Steiner (1945)
	Arrangement/Selection	Szondi Test	Szondi (1947)
	Arrangement/Selection	Lüscher Color Test	Lüscher and Scott (1969)
	Arrangement/Selection	Tomkin-Horn Picture Arrangement Test	Tomkins and Miner (1957)
	Expression	Projective Puppet Play	Woltmann (1960)
	Expression	Handwriting Analysis	Beyerstein and Beyerstein (1992)
	Reasoning	The Conditional Reasoning Test	James (1998)
	Judgement	Partially Structured Self-Concept Measures	Vargas, Von Hippel and Petty (2004)
	Judgement	Linguistic Intergroup Bias	Maass, Salvi, Arcuri and Semin (1989)

Justification: Defined as tests that use scenarios/situations to assess what a test respondent would think is a justifiable/reasonable way to act. Implicit tests, using justification as means of assessment, work on the assumption that individuals will project their own worldview on scenarios/situations offered by making judgments that support it (Greenwald, Poehlman, Uhlmann & Banaji, 2009; James, McIntyre, Glisson, Bowler & Mitchell, 2004).

Note. We build on the taxonomy proposed by Uhlmann et al. (2012) by combining disconnected literature on the types and categorization of implicit measures (Carter, Daniels & Zickar, 2013; Friese, Hofmann & Schmitt, 2008; Gawronski & De Houwer, 2014; Hofmann, Gschwendner, Nosek & Schmitt, 2005; Lindzey, 1959; Nosek, Hawkins & Frazier, 2011). Based on how implicit content is captured, we categorize 49 different implicit measures, according to eight different types of assessment techniques and we cluster them into three broader categories. Information about the popularity (i.e., number of citations) and origin (in which country each test was developed) is available from the first author on request.

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'Going implicit': Using implicit measures in organizations

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Implicit tests are increasingly being used and discussed in the field of Industrial-Organizational psychology. Despite their growing popularity, little is known about the types of implicit tests that exist, how they operationalize constructs, and how to improve their usefulness to predict relevant organizational behavior. We provide a timely contribution to practitioners and scholars who are considering adopting implicit measures in their organizations. By drawing on dual-processing theory, we reviewed the most prevalent implicit tests (Implicit Association Test, Picture Story Exercise, and Conditional Reasoning Test), and evaluated each against the following criteria: how they work, application areas, psychometric properties, perceptions of fairness, and faking potential. Based on prior empirical evidence, we provide ideas to improve these measures, how they may be applied in practice, and which avenues deserve future research. Together, these recommendations may enhance the value of implicit measures in organizations.

Key words: implicit cognition, Implicit Association Test (IAT), Picture Story Exercise (PSE), Conditional Reasoning Test (CRT), dual processing