Implicit or automatic processes are important in understanding the etiology and maintenance of psychopathological problems. In order to study implicit processes in psychopathology, measures are needed that are valid and reliable when applied to clinical problems. One of the main topics in this special issue concerns the development and validation of new or modified implicit tests in different domains of psychopathology. The other main topic concerns the prediction of clinical outcomes and new ways to directly influence implicit processes in psychopathology. We summarize the contributions to this special issue and discuss how they further our knowledge of implicit processes in psychopathology and how to measure them.

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1. Introduction

The past decades have witnessed a surge in psychological research on implicit cognitive processes, in a variety of research areas including memory (e.g., Squire, 1992), learning (e.g., Cleermans, in press), and social cognition (e.g., Bargh, 2005). Common to these different areas of research is an attempt to assess processes that are not readily captured by conscious introspection or cannot easily be controlled, but that nevertheless influence behavior. These processes are often called implicit. Although there is some debate about what the term “implicit” actually refers to, it might be most parsimonious to regard it as equivalent to the term “automatic” (De Houwer, 2006). Hence, implicit processes are processes that possess at least some of the features of automatic processes; for instance, they are difficult to control, are efficient or effortless, can occur unintentionally or outside of conscious awareness (see Bargh, 1994; Moors & De Houwer, 2006). The promise for psychological science in general is that these processes may drive important behaviors in everyday life.

Implicit processes might be particularly important in psychopathology. Because many forms of psychopathology are characterised by a lack of intentional control or by their
irrational nature, it is likely that implicit processes are particularly important in the etiology or maintenance of psychopathology. In addition, implicit processes are believed to be often affective in nature (e.g., Gawronski, Hofmann, & Wilbur, 2006) and emotion dysregulation is pivotal in psychopathology. New measures of implicit cognitive processes offer the hope of a better understanding of central processes in psychopathology that are not necessarily rational and that are sometimes difficult to understand, both for the patient and for the therapist. For example, it may help us to understand why people continue a variety of dysfunctional behaviors despite knowing that they should refrain from these actions, such as avoiding a harmless spider or a benign social situation, or continuing addictive behaviors that cause harm.

Attempting to assess implicit processes involved in psychopathology is in itself not new, and goes back to Freud’s free association methods and the use of projective tests, such as the famous thematic apperception test (TAT, see for a review McClelland, Koestner, & Weinberger, 1989). However, these methods were typically limited in that there was extensive opportunity for strategic, deliberative processing to influence performance on these tests. While we acknowledge that no method is process pure, and most paradigms capture a range of processes with both implicit and explicit components (see Conrey, Sherman, Gawronski, Hugenberg, & Groom, 2005; Jacoby, 1991), recent advances in cognitive science have led to far greater understanding and ability to isolate various features of implicit processing. Newly developed measures, such as the IAT (Greenwald, McGhee, & Schwartz, 1998), affective priming (Fazio 2001; Hermans, De Houwer, & Eelen, 2001) or the visual-probe test (MacLeod, Mathews, & Tata, 1986), are all firmly rooted in experimental psychology and great efforts have been undertaken to optimize experimental control (a far stretch from free association on the couch1). Implicit measures, like the ones used in this special issue, can be loosely subdivided in relation to the underlying processes they aim to assess: attentional processes (e.g., visual probe, MacLeod et al., 1986; emotional Stroop, Williams, Mathews, & MacLeod, 1996), appraisals or interpretations of ambiguous situations (e.g., Eysenck, Mogg, May, Richards & Mathews, 1991), or memory associations (e.g., first association methods, Stacy, 1997; affective priming, Fazio, 2001; IAT and later varieties such as the Go/No Go Association Task or GNAT, Nosek & Banaji, 2001, and the extrinsic affective Simon task or EAST, De Houwer, 2003).

In order to study implicit processes in psychopathology, measures are needed that are valid and reliable when applied to clinical problems. Hence, this special issue devotes considerable space to the development and validation of new or modified implicit tests. This emphasis on assessment is represented in the first six papers here (De Houwer & De Bruycker, 2007; Jongen, Smulders, Ranson, Arts, & Krabbendam, 2007; Rinck & Becker, 2007; Schrooten & Smulders, 2007; Shook, Fazio, & Vasey, 2007; Teachman, 2007; Phaf & Kan, 2007). In addition, implicit measures can help to increase our understanding of the functional relationship between implicit processes and psychopathology. For instance, implicit cognition measures can be used to predict treatment outcomes (e.g., Cox, Hogan, Kristian, & Race, 2002; Teachman & Woody, 2003), or to investigate whether an existing treatment has a differential impact on implicit versus explicit cognitive processes (e.g., Teachman & Smith-Janik, 2005; Teachman & Woody, 2003; 2006).

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1We note, however, that more controlled methods of assessing first associations have proven valuable in memory research and in applications to psychopathology (e.g., Stacy, 1997; Stacy et al., 2006).
Wiers, Van de Luitgaarden, Van den Wildenberg, & Smulders, 2005). This special issue highlights this approach in the paper by Huijding and De Jong (2007). Researchers are also beginning to directly influence the implicit cognitive processes involved in psychopathology. Two examples of such studies are presented in this special issue; both use information processing training to directly modify interpretation biases in anxiety (Mathews, Ridgeway, Cook, & Yiend, 2007; Salemink, Van den Hout, & Kindt, 2007).

We believe measures of implicit cognition hold considerable promise to advance our understanding of the development, maintenance, and reduction of serious clinical problems. With these long-term goals in mind, we now provide an overview of the papers reported in this special issue, highlighting how they present exciting initial steps to address new questions—and old questions in new ways—central to psychopathology. First, we will discuss those papers that focus on the development and validation of measures. Next, we describe the papers that focus on understanding the functional relationship between implicit processes and different types of psychopathology.

2. Development and validation of measures

Rinck and Becker (2007) used a new variant of a measure to assess spontaneous action tendencies, the approach-avoidance test (AAT). In a series of studies, they demonstrated that individuals with spider phobia on the one hand and control participants on the other hand differed in their ease of pushing versus pulling a joystick, where pushing stands for avoidance and pulling for an approach response. The authors added a new “zoom” feature to the measure, which made the stimulus appear to grow or shrink, enhancing the subjective experience of approach and avoidance. This measure is exciting because avoidance behavior is arguably the hallmark of pathological anxiety, so creating a paradigm that so closely integrates information processing and behavioral motivation may prove important for predicting critical clinical outcomes. Importantly, the AAT predicted fear-related behavior independently from questionnaires.

Schrooten and Smulders (2007) present a new affective variant of the spatial Simon task, which was designed to evaluate whether threat-relevant stimuli are preferentially processed so that they seem to ‘pop out’ to attract attention relative to other stimuli. Their study was designed to validate this novel measure (initially in a non-fearful sample), and most interestingly, to show that this attentional bias effect is influenced by contextual cues. They evaluated how participants attended to physical-threat and height-relevant words when exposed to a height (on a 12-m high walking bridge from glass) versus when in a traditional lab setting. This work is important because it shows the significance of taking context into account when examining threat-relevant processes. For instance, contextual cues have recently been recognized as important for determining return of fear after fear extinction has occurred (e.g., Mystkowski, Echiverri, Labus, & Craske, 2006). Thus, both their novel variant of a Simon task, and the contextual manipulation methodology they employ, may have considerable consequences for assessing attention biases in psychopathology.

De Houwer and De Bruycker (2007) tested a new variant of the EAST, the ID–EAST. The rationale for developing a new variant was that the original EAST (De Houwer, 2003) did not perform well enough (in terms of its psychometric properties) as a measure of inter-individual differences for clinical purposes. The authors suspected that the reason could have been that the irrelevant feature to which participants responded in the original EAST (word color) might not have required sufficient processing of the contents of the stimuli to
exert reliable effects. Therefore, the new variant was developed which required participants to process the stimuli, and still respond to an irrelevant feature (upper or lower case letters). With this task they found that heavy drinkers but not light drinkers had a positive attitude toward “beer”. This is interesting because many studies that have used variations of the IAT found strong negative implicit attitudes for alcohol (e.g., De Houwer, Crombez, Koster, & De Beul, 2004; Houben & Wiers, 2006; Wiers et al., 2005; Wiers, Van Woerden, Smulders, & De Jong, 2002) that contrasted with explicit positive attitudes. Importantly, ID–EAST scores were found to be reliable and showed predictive validity of (concurrent) alcohol use.

Shook et al. (2007) present data from a recently developed computerized learning task, called Beanfest, in which participants learn which beans are ‘good’ and which are ‘bad’, with a set of 100 different exemplar beans, varying in shape and texture. Previous research using this learning task showed a general negativity bias: participants are better at classifying bad beans than at classifying good beans. In the current study, Shook and Fazio explore to what extent individual differences in this measure are related to indices of (vulnerability for) psychopathology. Poorer learning was associated with a more negative cognitive style, greater depressive symptoms, and a tendency toward greater anxiety. Interestingly, learning about negative stimuli was unrelated to these measures; the observed relations stemmed from the poorer learning about positive stimuli. This novel task, in which learning about new stimuli is central (rather than examining automatic evaluations of previously learned stimuli), may open new ways of experimentally studying the development of biased cognitive processes in psychopathology.

Teachman (2007) validated an instrument to assess single-target associations (GNAT; Nosek & Banaji, 2001), in a sample of individuals with extreme spider fear. This was important because many of the available measures to examine implicit associations in memory require the relative comparison of two target constructs, even though only one is typically of interest. She demonstrated that the GNAT differentiated between the high-fear group and the control group, and this was specific for spider-fear evaluations (no difference was observed on a control fear GNAT task). In addition, performance in the GNAT spider-fear task was correlated with self-reported anxiety while approaching a live spider, and predicted whether or not participants touched the spider during this test. These results indicate that the GNAT can be a valuable tool for further research in psychopathology when single target evaluations are the priority.

Jongen et al. (2007) make a unique contribution to the special issue with their article examining attentional bias in bipolar disorder. First, they illustrate that implicit cognition measures may be important for increasing our understanding of a variety of types of psychopathology. As this special issue illustrates, much of the clinically relevant work in implicit cognition has occurred in the anxiety disorders field, and to a lesser extent in substance abuse/addictions research. Evaluating these biases in bipolar disorder effectively shows the reach of these tools because depressive disorders have often been thought to be less influenced by automatic processes than anxiety disorders are (e.g., Hartlage, Alloy, Vazquez, & Dykman, 1993). Second, by evaluating a modified version of the visual dot-probe task (a measure of preferential attentional engagement and disengagement toward emotion-relevant stimuli) in a sample of bipolar patients who varied in their mood state—some were euthymic while others had current depressive symptoms—the authors were able to evaluate the role of trait mood dysregulation (i.e., having bipolar disorder) versus state mood dysregulation. Understanding state–trait interactions and their effect on implicit
cognitive processes is an exciting step to elucidate the stability of these biases in psychopathology.

**Phaf and Kan (2007)** performed a meta-analysis on the famous emotional Stroop in relation to anxiety. Interestingly, the study sheds new light on the underlying processes in this old task. They included presentation condition (suboptimal—very brief and masked—or optimal) as one of the moderator variables and found reliable evidence for the emotional Stroop effect in anxious individuals, but only for optimal presentation times. Hence, the results did not support an emotional Stroop effect in anxiety for suboptimal presentation conditions, contrary to initial papers which even suggested *stronger* emotional Stroop effects for suboptimal stimuli (Fox, 1996; MacLeod & Hagan, 1992). One caveat for this conclusion is that the meta-analysis only included published papers, as the authors acknowledge. However, corrections for this bias strengthen the conclusion, and it should be noted that a publication bias most likely would have worked in the opposite direction (against reporting null findings for suboptimally presented stimuli after the initial positive findings, as the effects of the publication bias corrections also indicate). The results of this meta-analysis do not imply that there are no effects of suboptimal stimuli in anxiety (which have been demonstrated often with pictorial stimuli), but the weight of the evidence now suggests that this is not the case for word stimuli. The authors suggest that this difference could have an evolutionary background. The conclusions of the meta-analysis are in line with recent findings that indicate that slow disengagement processes are responsible for Stroop effects.

3. Clinical applications

**Huijding and De Jong (2007)** assessed two IATs—one measuring threat-related associations and the other measuring disgust-related associations—among individuals with spider phobia seeking treatment and among non-phobic control participants. Phobic individuals were assessed before and after one session of 2.5 h of in vivo exposure. To differentiate actual treatment effects from test–retest effects on the IAT, half of the phobic individuals completed the IAT tasks twice before treatment. Perhaps surprisingly, the authors found that only self-reported threat associations incrementally predicted participants’ overt avoidance behavior, and that these self-reported associations were significantly reduced following treatment. The IAT effects did not show a significant reduction following treatment, and no evidence was found for change over and above test–retest effects. The authors suggest that perhaps the IAT and similar methods are less suited for repeated measurement designs (cf. Wiers et al., 2005), which are of course important in treatment research. These findings raise central challenges concerning treatment sensitivity and the role of practice effects; critical issues to address in order for implicit measures to maximize their clinical utility.

As the field has developed and increasingly recognized the importance of information processing in psychopathology, researchers have begun to test the causal relation between implicit and explicit cognitive biases and clinical problems. Evaluating the presence of a bias in a clinical or analogue sample shows that this bias is correlated with the disorder, but actually manipulating the bias directly can test fundamental theoretical questions about the causal link between the bias and clinically significant distress and impairment. For example, MacLeod, Rutherford, Campbell, Ebsworthy, and Holker (2002) demonstrated that attentional training could change an attentional bias for negative emotional
stimuli among non-anxious students: remarkably, it could be trained toward or away from negative information. Importantly, students trained toward negative stimuli showed greater distress in a subsequent anagram task than those trained toward neutral stimuli. This type of research is of great theoretical importance for determining whether a psychological process has a causal effect on the disorder. In addition, the promise of this new type of research is that training may have therapeutic effects. Promising initial findings have been reported not only for anxiety (Mathews & Mackintosh, 2000; Mathews & MacLeod, 2002), but also for other disorders, such as addictive behaviors (Field & Eastwood, 2005; Schoenmakers, Wiers, Jones, Bruce, & Jansen, in press; Wiers et al., 2006).

Mathews et al. (2007) present one of the first attempts to do such a direct manipulation in a highly anxious sample. This is critical because showing that one can manipulate a bias in a healthy sample with information processing training does not necessarily mean the same manipulation will be successful in a fearful people who presumably have well-elaborated negative cognitive biases toward their feared object. Mathews and colleagues trained high trait-anxious participants over four sessions to resolve descriptions of ambiguous events in an increasingly positive manner. They found that the group trained in this way made more positive interpretations of novel descriptions at post-test relative to a test–retest control group, indicating that they were generalizing the training to new situations. Moreover, trait anxiety scores reduced more in the trained group than in the untrained control group. These findings are important not only from a theoretical perspective; training biases also have exciting clinical applications because it provide a way to potentially reduce fear that does not rely on exposure-based interventions, which many clients are fearful to attempt.

Interestingly, Salemink et al. (2007) also replicated the effects of the interpretation bias training using the original measures (among a non-anxious student sample), but they did not find effects of this training on other measures of interpretation bias (cf. Schoenmakers et al., in press). This could represent a lack of generalization (i.e., the training effects are limited in that they do not apply to other ways of misinterpreting threat in the environment), or alternatively, could be due to poor reliability or validity of the assessment instruments (again, providing valuable information for further refinement of assessment methods). This is a non-trivial issue because lack of agreement among different measures of fear responding, termed ‘desynchrony’, has long plagued anxiety disorders research (see Lang, 1985), so determining to what extent low agreement among seemingly related measures is due to real individual differences or to measurement error is critical. Importantly, the current study did find interpretation training effects on anxiety, supporting the clinical relevance of the new training methods, and value of pursuing these exciting questions.

4. Concluding remarks

We believe the papers presented in this special issue provide an exciting sample of the many new directions in research on implicit cognitive processes in psychopathology. Together, the studies demonstrate that it is possible to study these processes using novel tools that can provide new insights into psychopathology and the factors maintaining clinical disorders. In addition, the promise that pathogenic processes may be directly altered (e.g., through information processing training) is exciting, although it should be
noticed that research in this domain is in its infancy, and many open questions need to be resolved before regular clinical application is feasible.

The papers also raise a number of issues for further research:

- There is a continued need for further refinement and validation of measures of implicit cognitive processes, both in the more general methodological sense (enhancing the psychometric properties of the measures), and in their specific applications to psychopathology. This will help determine exactly which features of automaticity are most central to clinical phenomenology (e.g., lack of awareness, involuntariness, etc.).
- To enhance clinical utility, there is a need for measures that are both reliable and sensitive to change. These two features are often particularly hard to co-achieve with clinical populations and constitute a challenge for future research.
- Currently, there is little research into the interplay of different implicit processes. Attentional, interpretation, and memory biases can, but do not need to, be related. This issue relates both to theory (models of various processes involved in different disorders) and to assessment (an association between two processes can only be established if both can be assessed in a reliable and valid way).
- A related issue concerns the biological (neural/genetic) underpinnings of the implicit processes under study. Although not addressed in the papers here, this constitutes an important avenue for future research.
- Adding implicit measures to clinical treatment studies may increase our understanding of the intervention process; important for determining mechanisms of change, predictors of treatment response and maintenance of gains following treatment. As yet, very few of these studies have been undertaken.
- Similarly, there have been few prospective longitudinal studies to evaluate how implicit processes may confer risk for the development of psychopathology.
- Finally, although the recent surge of interest in direct ways to alter implicit cognitive processes in psychopathology is exciting, there are unresolved questions about durability, generalization to other cognitive processes, and the critical ingredients for this type of intervention (i.e., what is the mechanism that changes the implicit process, or does training instead alter more general processes like motivation to change?).

We see these open questions as exciting rather than discouraging—application of implicit cognition measures to psychopathology research is a relatively new field, and we hope this special issue stimulates further research in this fascinating area of research.

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References


Reinout W. Wiers*
Experimental Psychology, Maastricht University,
Maastricht, The Netherlands

Behavioral Science Institute (BSI),
Radboud Universiteit Nijmegen, The Netherlands

IVO Addiction, Research Institute, Rotterdam, The Netherlands

E-mail address: R.Wiers@psychology.unimaas.nl

Bethany A. Teachman
University of Virginia,
Charlottesville, VA, USA

Jan De Houwer
Ghent University, Ghent, Belgium

*Corresponding author. Experimental Psychology; Uns 40, University of Maastricht, PO BOX 616; 6200 MD Maastricht, The Netherlands. Tel.: +31 43 388 1935/1908.