

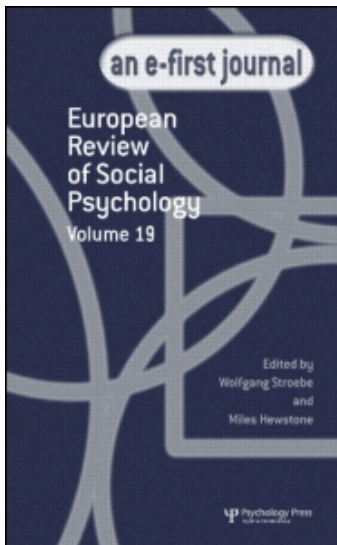
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When and why do implicit measures predict behaviour? Empirical evidence for the moderating role of opportunity, motivation, and process reliance

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When and why do implicit measures predict behaviour? Empirical evidence for the moderating role of opportunity, motivation, and process reliance

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The ability of implicit measures to predict behaviour varies greatly across studies, emphasising the need for accounts of this variability. In order to organise and review the literature on moderators that influence individuals' information processing, we suggest a classification system of moderators with two dimensions. One dimension distinguishes moderators according to their influence on the opportunity to control, the motivation to control, or the reliance on either automatic or controlled processes without changes in opportunity or motivation. The second dimension classifies moderators according to whether they pertain to a disposition of the acting person, the situation in which the behaviour occurs, or the behaviour itself. Increased predictive validity of implicit measures is associated with conditions that foster the impact of automatic processes on behaviour determination. In the discussion we derive several additional moderators from the classification system, delineate emerging research questions, and discuss implications of the reviewed studies for research on self-regulation.

Keywords: Attitude-behaviour consistency; Behaviour; Implicit measures; Moderator; Predictive validity.

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The idea that human behaviour is not solely a result of controlled and conscious thought but is also influenced by automatic processes has long influenced the thinking of psychologists (e.g., Freud, 1933; James, 1890). The last 20 years or so have seen a tremendous amount of work on automatic processes, providing abundant evidence that these processes indeed play an important role in behaviour regulation (e.g., Dijksterhuis & Bargh, 2001; Greenwald & Banaji, 1995; Hassin, Uleman, & Bargh, 2005).

An important challenge for psychological research is to measure the implicit dispositions such as implicit attitudes, self-esteem, or personality traits that drive behaviour through automatic processes. Although direct self-report measures have undoubtedly allowed for great progress in predicting human behaviour (e.g., Ajzen, 2001; Glasman & Albarracín, 2006), they may not be optimal for assessing the largely automatic sources of behaviour for at least two reasons: First, although responses on direct self-report measures may be influenced by automatic processes to a certain extent, they primarily tap into consciously accessible knowledge structures as they rely on introspection (Gawronski & Bodenhausen, 2006; Greenwald et al., 2002). This understandably limits the ability of such measures to predict behaviour to the extent that the underlying automatic processes are inaccessible to conscious awareness. Second, such measures are especially susceptible to response factors such as self-presentation and faking strategies (Crowne & Marlowe, 1960; Greenwald et al., 2002; Nederhof, 1985). As a result, psychologists have repeatedly suggested using indirect measures that suffer less from such deficiencies (Greenwald & Banaji, 1995).

Indirect measures do not openly ask participants for a self-assessment of the to-be-measured construct. For example, to study a particular attitude, participants would instead be asked to engage in a behaviour that is assumed to be influenced by the attitude of interest (De Houwer, 2006). Projective (e.g., Thematic Apperception Test, Rorschach Inkblot Test; Lilienfeld, Wood, & Garb, 2000; Proshansky, 1943) and non-reactive measures (e.g., behavioural observation, the study of traces of behaviour, archival data, etc.; Webb, Campbell, Schwartz, Sechrest, & Grove, 1981) are cases in point. However, although projective techniques are widely used in clinical psychology, very low reliabilities often impede satisfactory predictive validity on an individual basis (Lilienfeld et al., 2000). Non-reactive measures are often very laborious to collect and therefore hard to use for many research purposes. In addition, their validity has been questioned too (Bohner & Wänke, 2002).

In recent years an abundance of indirect measures have been developed, often referred to as *implicit measures* (for reviews, see Fazio & Olson, 2003; Wittenbrink & Schwarz, 2007). Some examples of these measures include concept priming (Wittenbrink, Judd, & Park, 1997), evaluative priming (Fazio, Sanbonmatsu, Powell, & Kardes, 1986), the Implicit Association

Test (IAT) and its variants (Greenwald, McGhee, & Schwartz, 1998; Karpinski & Steinman, 2006), the Extrinsic Affective Simon Task (EAST, De Houwer, 2003), or the Affect Misattribution Procedure (AMP, Payne, Cheng, Govorun, & Stewart, 2005).¹ Implicit measures are intended to tap into mental associations without relying on a person's ability and/or willingness to be introspective (Fazio & Olson, 2003). Because several current information-processing models in social psychology assume that such associations can play an important role in behaviour determination (Chaiken & Trope, 1999; Evans, 2008; Smith & DeCoster, 2000), researchers have hoped that implicit measures would not merely predict behaviour, but even explain unique variance over and above direct self-report measures (Fazio & Olson, 2003).

The question of whether or how well implicit measures are able to predict behaviour is a core issue from the perspective of both personality and social psychology. The consistency between individual difference measures and behaviour has been questioned repeatedly in psychology (Hartshorne & May, 1928; LaPierre, 1934; Mischel, 1968; Wicker, 1969). Reminiscent of these debates, doubts have been raised with regard to implicit measures and their ability to predict behaviour (e.g., Karpinski & Hilton, 2001; Tetlock & Mitchell, 2008a, 2008b).

Researchers have made great efforts to scrutinise the question of whether or not implicit measures predict behaviour at least to some extent. The answer is yes. For instance, a recent meta-analysis on the predictive validity of IAT measures found an average weighted predictive validity for judgements, choices, physiological responses, and behaviours of $r = .27$ (Greenwald, Poehlman, Uhlmann, & Banaji, in press; see also Fazio & Olson, 2003). In this meta-analysis, 95% (± 2 SD from the mean) of all weighted empirical IAT criterion correlations varied from $-.13$ to $.67$. Given such large variations in effects, it may be fruitful to direct more attention to the boundary conditions under which implicit measures will be more and less likely to predict behaviour, and to integrate the evidence into theoretical models that can account for this variation. This process resembles the

¹Although this class of measurement techniques enjoys great popularity there is no widespread agreement on what, exactly, the term "implicit" should indicate. Sometimes it is meant to imply that respondents are not aware of what is measured, other times that respondents cannot strategically control the outcome of the measure, and/or that these measures work without intention and work efficiently. These functional properties reflect the criteria of automaticity in the sense of Bargh (1994). Although it is likely that implicit measures fulfil some of these criteria, it is unlikely that there are measures that meet all of these expectations. Consequently, De Houwer (2006) suggested defining "an implicit measure as a measurement outcome that reflects a certain attitude or cognition in an automatic manner, where 'automatic' needs to be specified in terms of the presence of one or more functional features" (p. 14; for reviews, see De Houwer, 2006; De Houwer & Moors, 2007; De Houwer, Teige-Mocigemba, Spruyt, & Moors, in press).

development in previous consistency debates of the last century, during the course of which the focus of attention shifted from the question of whether or not attitudes and personality traits predict behaviour to the questions of *when* and *how* they predict behaviour (Kenrick & Funder, 1988; Zanna & Fazio, 1982).

In the following we will briefly discuss the class of dual-process models as an appropriate theoretical background. From these models we will derive a classification system of moderators that can be used to structure and review the empirical evidence. In the discussion we will derive predictions for new potential moderators based on this classification system, develop additional research hypotheses, and discuss various implications of the set of studies reviewed here.

DUAL-PROCESS MODELS

A great number of dual-process models have been proposed in cognitive and social psychology, many of which share some core assumptions (Chaiken & Trope, 1999; Evans, 2008; Smith & DeCoster, 2000). Most centrally, the models assume that different kinds of processes contribute to human behaviour determination. Theorists have proposed different denotations to distinguish between these different processes, such as associative versus rule-based (Sloman, 1996; Smith & DeCoster, 2000), experiential versus rational (Epstein, 1994), hot versus cool (Metcalf & Mischel, 1999), spontaneous versus deliberative (Fazio & Towles-Schwen, 1999), or impulsive versus reflective (Strack & Deutsch, 2004). In this chapter we will employ the widely used terms *automatic processes* and *controlled processes* (Schiffrin & Schneider, 1977).

Automatic processes are assumed to be based on an associative network that operates in a fast, effortless, and unintentional manner. In contrast, controlled processes are assumed to be based on higher-order mental processes of reasoning that influence judgements and behaviour in a slower, more effortful, and intentional manner (Bargh, 1994; Evans, 2008). Several models postulate both kinds of processes to jointly guide behaviour (e.g., Fazio, 1990; Smith & DeCoster, 2000; Strack & Deutsch, 2004). Notably, the opportunity and motivation to control behaviour are capable of shifting the relative weights of automatic and controlled processes for a given behaviour: Because controlled processes are laborious they will only be influential in guiding behaviour if the opportunity to engage in controlled processing is given and if the person is sufficiently motivated to do so. If a person either does not have the opportunity for controlled processing and/or is not motivated, automatic processes will have a greater impact.

Implicit measures assess largely automatic processes (Conrey, Sherman, Gawronski, Hugenberg, & Groom, 2005; De Houwer, Teige-Mocigemba,

Spruyt, & Moors, in press; Greenwald & Banaji, 1995; Payne, 2005; Sherman et al., 2008). Consequently, to the extent that automatic processes drive behaviour, implicit measures should be successful in predicting behaviour. The more similar the processes influencing the measurement outcome of an implicit measure are to the processes influencing a behaviour, the higher the predictive validity of this measure for this behaviour (De Houwer, 2006). The predictive validity of implicit measures should therefore decrease with an increasing relative weight of controlled processes on behaviour determination, because controlled processes are assumed to be able to inhibit or override automatic processing.²

CLASSIFICATION OF MODERATORS

We drew on the framework offered by the dual-process models to organise the empirical evidence along two dimensions. The first dimension specifies three determinants of moderation: *opportunity to control*, *motivation to control*, and *process reliance* (see Table 1). The first two determinants, opportunity and motivation to control, can be derived from a number of dual-process models. According to these models, both opportunity and motivation are needed in order for controlled processes to guide behaviour. If a person does not have either the opportunity or the motivation to engage in effortful information processing, automatic processes will be more influential in guiding behaviour. Therefore, any factors (i.e., moderators) that reduce either the opportunity and/or motivation to control should increase the impact of automatic processes and decrease the impact of controlled processes on behaviour determination.

An abundance of empirical studies in numerous subdisciplines of psychology has either measured or manipulated participants' opportunity and/or motivation and found results that are consistent with the assumptions of dual-process models (e.g., Evans, 2008). Based on this research one may conclude that variance in opportunity and motivation to control are sufficient for changing the relative weight of controlled and automatic processes in information processing. However, they are not

²In this chapter we draw on dual-process models to organise the literature on moderators and to derive predictions for the predictive validity of implicit measures. Many of the primary research articles based their arguments on similar theoretical grounds. However, we would like to stress that this review is *not* intended to be a comprehensive test of the validity of dual-process models. Other models propose a single process (e.g., Kruglanski, Erb, Pierro, Mannetti, & Chun, 2006) or more than two different processes (e.g., Conroy et al., 2005; Sherman et al., 2008) to operate. We do not claim that only dual-process models can account for the empirical results reviewed here, nor is it a goal of this work to test this possibility. However, we do think that dual-process models provide a valuable framework for integration that appears to strike a good balance between explanatory power and parsimony.

TABLE 1
 Classification system of moderators found to increase the predictive validity of implicit measures of behaviour

<i>Mode of functioning</i>	<i>Determinants of moderation</i>		
	<i>Opportunity to control</i>	<i>Motivation to control</i>	<i>Process reliance</i>
Dispositional	<ul style="list-style-type: none"> • Low working memory capacity • Low trait self-control • High trait impulsivity • Low control over non-verbal behaviour 	<ul style="list-style-type: none"> • Low motivation to be egalitarian • Low need for cognition • Low motivation to control prejudiced reactions 	<ul style="list-style-type: none"> • High preference for intuition • Chronic promotion rather than prevention focus
Situational	<ul style="list-style-type: none"> • Low cognitive capacity • Low processing time • Low self-regulatory resources • Mortality salience • Alcohol intoxication 	<ul style="list-style-type: none"> • Hedonic need states • Social control^a 	<ul style="list-style-type: none"> • Affective rather than cognitive focus • Positive rather than negative mood • Promotion rather than prevention focus • Construct-activation affecting the validity of the measurement outcome
Behavioural	<ul style="list-style-type: none"> • Low controllability 		<ul style="list-style-type: none"> • Construct-activation affecting the execution of behaviour • Uncertainty • High habitualness

^aThe empirical data with regard to social control are inconclusive so far (see the respective section for details).

necessary conditions. Other factors lead individuals directly to trust or not trust inner cues such as automatically activated associations as a valid basis for behaviour determination. Phrased differently, individuals may rely on either controlled or automatic processes without changes in opportunity and/or motivation (Bless & Schwarz, 1999; Smith & DeCoster, 2000). We account for these factors by introducing a third determinant of moderation, process reliance. Although such a third determinant next to opportunity and motivation is not a typical feature of many dual-process models, it is included in some of them. For example, in their integrative dual-process model Smith and DeCoster (2000; see also Epstein, 1994) incorporate several influences that lead to a reliance on either kind of processes and that are explicitly stated to be different from opportunity and motivation. Examples of this determinant provided by Smith and DeCoster are a reliance on one's intuition, reliance on one's inner affective reactions, or mood (for further examples see the respective section below).

Mood is a suitable concept to illustrate the reasoning behind the determinant process reliance. Differences in mood have been consistently shown to affect the depth of information processing, with a higher impact of automatic processes for a good mood as compared to a sad mood (Bodenhausen Kramer, & Süsser, 1994; Schwarz & Clore, 1996). Some of these effects may be attributable to changes in opportunity and motivation to control behaviour (Isen, 1987; Mackie & Worth, 1989; Schwarz, 1990). However, in an intriguing research programme Bless and colleagues showed that mood effects on information processing also occur via a direct route, *independently* of variations in opportunity and motivation (Bless, 2001; Bless et al., 1996a; Bless, Schwarz, & Wieland, 1996b).

The second dimension of our classification scheme organises the moderators as to whether they primarily pertain to a disposition of the acting person, to the situation, or to the behaviour that is carried out. Especially early research on the predictive validity of implicit measures assumed that implicit measures particularly predict different *kinds* of behaviour than explicit self-report measures. That is, implicit measures were assumed to predict non-verbal behaviours that are hard to control, whereas explicit measures were assumed to predict verbal behaviours that are easier to control (e.g., Asendorpf, Banse, & Mücke, 2002; Dovidio, Kawakami, Johnson, Johnson, & Howard, 1997; Fazio, Jackson, Dunton, & Williams, 1995). However, even one and the same behaviour (e.g., the consumption of a tempting food) may be influenced to different degrees by automatic and controlled processes depending on the circumstances. For instance, the behaviour of individuals who dispositionally have a low opportunity (or motivation) to control may be more strongly influenced by automatic processes than the same behaviour carried out by individuals with high opportunity (or motivation) to control. The same logic applies to temporary

fluctuations when those individuals whose opportunity or motivation to control has been situationally reduced are compared to other individuals whose opportunity and motivation to control are intact. The second dimension of the classification scheme differentiates these different modes of functioning and allows testing for functionally equivalent moderation effects across all three modes. Table 1 depicts the moderators included in this review arranged on the two dimensions (see the Appendix for specifics of the literature reviewed).

SELECTION OF DATABASE

To compile the database for this review we used the following procedure. First, we performed a PsychInfo search with the keywords “implicit” and each of the following terms: “predictive validity”, “moderator”, and “moderation”, as well as a search including “implicit measure” and “behaviour” or “behavior”. Subsequently we scanned the results sections of all papers for indications of moderating effects on the predictive validity of an implicit measure. Second, we posted requests for published or unpublished manuscripts reporting research “that investigated moderators of the predictive validity of implicit measures” via the email lists of the European Association of Social Psychology (EASP) and the Society of Personality and Social Psychology (SPSP). The requests noted that we were particularly interested in studies featuring actual behaviour such as interaction, choice, or consummatory behaviour. Third, we included studies that were distributed via an informal email list of researchers involved with implicit measures. Fourth, we included studies that we were aware of through various other sources such as conference presentations or personal communication provided that a (published or unpublished) manuscript was available reporting the study details.

In the final dataset we included studies that (a) featured an implicit measure assessing individual differences to predict (b) “real” behaviour (Baumeister, Vohs, & Funder, 2007); that is, social interactions, actual choice, consummatory behaviours, and the like. We focused on studies that (c) specifically investigated *moderators*; that is, conditions assumed to increase or decrease predictive validity. In particular, we were interested in moderators that affected individuals’ information processing.

The majority of the reviewed studies investigated the respective behaviour in laboratory settings. As some behaviours are difficult if not impossible to observe in a laboratory environment (e.g., whether people use condoms during sexual encounters; or behaviours that spread over a longer time span such as general consumption patterns), we relied on self-reports about these behaviours in such instances. We excluded studies that fell short of the real behaviour standard using criterion variables such as questionnaires asking

for behaviours in hypothetical scenarios, behavioural intentions, or judgements. Although we do not doubt that such measures may yield important information under certain conditions, we felt that a restriction to studies featuring real behaviour would provide a stricter test for hypotheses related to moderators of the predictive validity of implicit measures. However, there is one qualification to this standard: For a few theoretically substantiated moderators that have not yet been investigated with measures of real behaviour, we include one illustrative study that featured only a proxy of behaviour as the criterion variable.

With this focus, the present narrative review differs in various aspects from related work in the field (Greenwald et al., in press). First, in their meta-analysis, Greenwald and colleagues focused on the predictive validity of IAT measures only, whereas the present review includes studies using various different implicit measures.

Second, Greenwald and colleagues included all criterion measures that did not represent (a) self-report measures of the same construct that was assessed with the IAT, or (b) another implicit measure. The resulting criterion measures encompass, for example, judgements (e.g., relationship satisfaction) and physiological responses (e.g., neurological activations). In contrast, the present review uses a stricter criterion for predictive validity, focusing on observable “real” behaviours (Baumeister et al., 2007). Real behaviour is preferred as a criterion (a) because it is the consistency between individual difference measures and behaviour that has been challenged most vividly during the consistency debates and also with regard to implicit measures (e.g., Karpinski & Hilton, 2001; Tetlock & Mitchell, 2008a, 2008b), (b) because unlike proxies of behaviour such as behavioural intentions and judgements, real behaviour is less affected by limitations typically associated with explicit measures (e.g., social desirability concerns or imperfect introspective abilities), and (c) because the prediction of real behaviour is considered by many to be the ultimate test for the validity and usefulness of a psychological construct, model or theory.

Third, and central for the present purposes, the investigation of moderators differs between the two articles. Greenwald and colleagues explored various potential moderators that were conceptual (e.g., social sensitivity of the topic under investigation), methodological (e.g., order of measures), or publication based (e.g., publication year). Most of these characteristics were post-hoc rated by the authors for each study. In contrast, the present review focuses on moderators that were hypothesised to affect the information processing of individuals. In addition, it enjoys the advantage that the included studies aimed specifically at investigating moderators. That is, a theoretically derived moderator was either measured as an individual difference variable or experimentally manipulated, or different kinds of behaviours that were a priori hypothesised to differ with regard to the respective moderator were analysed separately. This allows for

a high degree of confidence in the empirical findings as variation in the moderator constructs is investigated within studies instead of between studies. Therefore, possible confounding differences between the studies are unlikely to account for any of the moderator effects. Lastly, the present review offers a classification system of moderators that is (a) grounded in theoretical models and (b) combines research paradigms (experimental and correlational) that are, unfortunately, often employed in isolation.

In the following we will review the empirical evidence along the lines of the classification system, starting with the left column in Table 1, moderators pertaining to the opportunity to control.

MODERATORS PERTAINING TO THE OPPORTUNITY TO CONTROL

The opportunity to control is a necessary precondition for controlled processing (Chaiken & Trope, 1999; Smith & DeCoster, 2000). Thus, implicit measures should be better at predicting behaviour for individuals who dispositionally or situationally lack the resources to engage in controlled processing as compared to those individuals who have plenty of resources available. Additionally, implicit measures should better predict behaviours that are hard to control as compared to those that are easier to control.

Dispositional moderators pertaining to the opportunity to control

Working memory capacity (WMC). The higher the WMC, the better the ability to, first, maintain relevant information such as personal standards as active in working memory, and, second, to shield this information from any external or internal distractions (such as automatically activated impulses; e.g., Barrett, Tugade, & Engle, 2004; Engle, 2002). In the domain of cognitive abilities such as reading and arithmetic reasoning, individuals high in WMC have been shown to be more successful in enacting controlled, goal-directed processing than individuals low in WMC (Barrett et al., 2004). Drawing on these findings, one can hypothesise that high-WMC individuals may be better at overriding automatic influences as compared to low-WMC individuals. Thus, the predictive validity of implicit measures should be higher in the latter group.

Several studies support this assumption. In a study on sexual interest behaviour (Hofmann, Gschwendner, Friese, Wiers, & Schmitt, 2008b, Study 1), male participants completed an evaluative (i.e., using evaluative attribute categories like *pleasant* and *unpleasant*) Single Category Implicit Association Test (SC-IAT, Karpinski & Steinman, 2006) on erotic pictures and a measure of WMC (Oberauer, Süß, Schulze, Wilhelm, & Wittmann, 2000).

Later they were asked to look at various erotic pictures and pictures of modern art until they felt comfortable enough to answer a couple of questions about each picture. As expected, the SC-IAT predicted viewing time of the erotic relative to the art pictures for participants with low WMC, but not for participants with high WMC. The opposite pattern emerged for an explicit attitude measure. In a second study an SC-IAT (relating to candy) predicted candy consumption in a taste-and-rate task, but only for participants low in WMC. Conversely, the motivation to forgo candy that was assessed directly with a questionnaire predicted consumption for participants high in WMC, but not for those low in WMC.

Another study was concerned with anger expression after a mild provocation (Hofmann et al., 2008b, Study 3). In a first session, participants completed a self-concept angriness IAT (i.e., an IAT using attribute categories like *me* and *others*), a WMC task, and an explicit measure of self-reported anger control (Schwenkmezger, Hodapp, & Spielberger, 1992; Spielberger, 1988). During the second session participants received negative feedback about their performance in the first session and had the chance to retaliate against the person who had given them the negative feedback. As expected, the self-concept IAT predicted the level of expressed sympathy for the provocateur for participants with low but not high WMC. Conversely, self-reported anger control exerted a moderating effect on sympathy ratings only in high-WMC and not in low-WMC individuals.

Similar results were obtained by Thush et al. (2008) who used a different measure of WMC (Petersen, Pihl, Higgins, & Lee, 2002; Petrides & Milner, 1982). They found an IAT assessing positive-arousal associations with alcohol to predict self-reported alcohol consumption (i.e., the average of several indicators of alcohol consumption such as the number of times alcohol used in the past month or the number of standard drinks on a weekend day) for participants with low but not with high WMC. The opposite pattern emerged for explicitly assessed positive-arousal associations.

A final study (Grenard et al., 2008) used a word association task of associative memory as an implicit measure (Stacy, Ames, & Grenard, 2006). This task measures spontaneous, drug-related associations in memory with paper-and-pencil procedures. Participants also completed a WMC measure (Peterson et al., 2002) and provided information about their consumption of alcohol and cigarettes. The number of alcohol-related (tobacco-related) associations was more strongly related to self-reported alcohol (tobacco) consumption for participants low than high in WMC.

In sum, WMC moderated the predictive validity of various implicit measures (IAT, SC-IAT, word associations) assessing different kinds of associations (evaluative, positive arousal, self-concept, non-evaluative drug-related) and equivalent effects emerged for different measures of WMC (Oberauer et al., 2000; Peterson et al., 2002).

Trait self-control. Self-control is “the ability to override or change one’s inner responses, as well as to interrupt undesired behavioral tendencies and refrain from acting on them” (Tangney, Baumeister, & Boone, 2004, p. 275). High levels of trait self-control are associated with more success in life on a variety of dimensions such as academic achievement, psychological adjustment, and coping with tempting situations (Shoda, Mischel, & Peake, 1990; Tangney et al., 2004). Individuals low in trait self-control are assumed to follow through more often on their impulses and have more difficulty living up to personal standards and goals (e.g., Baumeister, Gailliot, DeWall, & Oaten, 2006; Gailliot & Baumeister, 2007). Consequently, implicit measures should predict behaviour better for individuals low in trait self-control.

In one study (Frieze & Hofmann, 2008a), participants completed the self-control scale by Tangney et al. (2004) in a first session. In a second session, an evaluative SC-IAT predicted the amount of potato chips consumed in a later taste-and-rate task better for participants low as compared to high in trait self-control, as expected. Two further studies found similar effects using an SC-IAT and an AMP with regard to self-reported regular amounts of alcohol consumption (SC-IAT and AMP) and consumption during the previous week (SC-IAT). The replication of the effect with a measure that relies on response competition (SC-IAT) and one that does not (AMP) allows to rule out with some confidence the possibility that task-specific influences underlie this effect (Gawronski, Deutsch, LeBel, & Peters, 2008). In addition, in the alcohol studies the effects persisted when controlling for trait impulsivity (Barratt, 1994; Eysenck, Daum, Schugens, & Diehl, 1990; Eysenck, Pearson, Easting, & Allsopp, 1985), a construct conceptually related to trait self-control.

Trait impulsivity. Trait impulsivity and trait self-control look at the same phenomenon, but from a different perspective. Whereas trait self-control focuses on control and overriding, trait impulsivity highlights different aspects of a lack of control (Barratt, 1994). High impulsivity is associated with a lack of planning, spontaneous decision making, and acting without thinking (Barratt, 1985; Eysenck & Eysenck, 1977). Accordingly, implicit measures should predict behaviour better for individuals high as compared to low in trait impulsivity.

The studies reported above on the moderating role of trait self-control with regard to alcohol consumption (Frieze & Hofmann, 2008a) simultaneously investigated the role of trait impulsivity (Eysenck et al., 1985, 1990). An SC-IAT predicted participants’ alcohol consumption during the previous week for participants high, but not low, in trait impulsivity (Study 2a). This moderation did not appear for regular amounts of alcohol consumption. In another study (Study 2b), trait impulsivity similarly

moderated the predictive validity of an AMP for self-reported regular alcohol consumption, but not consumption during the previous week. When controlling for the effects of trait self-control in simultaneous regression analyses, these moderator effects did not hold, whereas the moderator effects of trait self-control persisted (see above). Although these results point at the theoretically plausible moderating role of trait impulsivity, the empirical findings are not consistent. Research featuring different criterion measures than self-reported alcohol consumption is desirable.

Control over nonverbal behaviour. Nonverbal behaviours (e.g., facial expressions, body posture) are generally more difficult to control than verbal behaviours (see section below on controllability of behaviour as a moderator), even though control over nonverbal behaviours is not impossible (DePaulo, 1992). Whereas some people are relatively unaware of their body language and unskilled at correcting it, others are aware of it and practised at controlling these cues (Dasgupta & Rivera, 2006). Hence, implicit measures should predict nonverbal behaviours better for individuals with low control over these behaviours as compared to individuals who are good at controlling them.

Two studies investigated this hypothesis (Dasgupta & Rivera, 2006). Participants completed an evaluative gay–heterosexual IAT and a self-report measure assessing the extent to which they were controlling their nonverbal behaviour (e.g. “I try to keep an eye on my own actions when I’m interacting with others so that I don’t behave in a discriminatory manner without thinking”). In a separate session, participants interacted with a presumably gay man, and their nonverbal behaviours (e.g., the amount of eye contact with the confederate or their body posture) served as the criterion measure. Among male participants with a low motivation to be egalitarian (see section on dispositional moderators pertaining to the motivation to control), high implicit prejudice was associated with less positive behaviour for participants low as opposed to high in control over nonverbal behaviours. Notably, participants high in both implicit prejudice and behavioural control showed more positive behaviour than participants low in implicit prejudice. This result suggests that high behavioural control even allowed for an overcorrection of participants’ implicit prejudice. These results were replicated for both female and male participants in a second study.

Situational moderators pertaining to the opportunity to control

Cognitive capacity. Temporarily reduced cognitive capacity decreases the influence of controlled processes on judgements and behaviour while

simultaneously increasing the influence of automatic processes that are less susceptible to capacity constraints (e.g., Baddeley, 1996; Gilbert, Pelham, & Krull, 1988; Shiv & Fedorikhin, 1999). Consequently, implicit measures should predict behaviour better under reduced as compared to full cognitive capacity. Several studies support this assumption.

In one study participants completed self-report measures in the first session and an IAT relating to chocolate and fruit in the second session (Friese, Hofmann, & Wänke, 2008, Study 1). At the end of the second session, participants could choose five items from a selection of fruit pieces and chocolate bars as compensation for their efforts. Half of the participants performed the choice task with nearly full cognitive capacity, keeping in mind a one-digit number. The other half were instructed to keep in mind an eight-digit number (Gilbert & Hixon, 1991). The IAT predicted choice behaviour well for participants with reduced cognitive capacity, but not for those with full cognitive capacity. The opposite pattern emerged for the self-report measure.

Similar results emerged from a study by Gibson (2008, Study 2) in which participants first underwent an evaluative conditioning procedure (see Olson & Fazio, 2001) in favour of either Coke or Pepsi. This manipulation affected participants' scores in a subsequent Coke–Pepsi IAT in the expected direction. Later, participants chose between a can of Coke or a can of Pepsi on the computer screen and one half of participants was instructed to keep in mind an eight-digit number. As expected, the IAT improved the prediction of product choice over and above explicit evaluations of the soft drinks for participants in the high-load condition, but not in the low-load condition.

Further evidence comes from the domain of interracial interaction behaviour (Hofmann, Gschwendner, Castelli, & Schmitt, 2008a, Study 1). First, Italian participants completed an Italian–African IAT and explicit attitude measures. In a supposedly unrelated study participants had two short conversations, one with an Italian and one with an African confederate. Half of each conversation was undisturbed, with no manipulation of cognitive capacity. During the other half, participants were cognitively taxed by having to remember as many words as possible from a list studied prior to the conversation. As expected, more positive implicit attitudes towards Africans relative to Italians predicted greater visual contact with the African confederate when participants were cognitively busy, but not when they had full capacity. A similar pattern occurred with regard to speech illustrators (gestures) that are used to underline one's communication. The explicit attitude measure failed to predict these behaviours in both capacity conditions. In contrast, it predicted the perceived competence of the African relative to the Italian interviewer. This finding corroborates assumptions because the interviewer competence ratings were administered after the conversations with full

resources available. Comparable results were obtained in a replication study involving interactions between German participants and Turkish confederates.

Conflicting evidence comes from a study by Scarabis, Florack, and Gosejohann (2006). Participants chose between a piece of fruit and a chocolate bar while being either cognitively busy (keeping in mind a six-digit number) or cognitively not busy (keeping in mind a one-digit number). After this task they completed self-report measures, an evaluative, and a self-concept IAT relating to fruit and chocolate. Contrary to expectations, cognitive capacity did not affect the predictive validity of the IATs. Possible reasons for this unexpected finding may lie in the smaller number of digits that participants had to keep in mind as compared to the studies by Friese et al. (2008) and Gibson (2008, six vs eight digits) or the nature of the choice task (choice on the computer screen vs actually grabbing the objects in the Friese et al. study, and choice between two options vs choosing five objects out of a large number of options).

Processing time. Time pressure leads people to consider less information, rely more on stereotypes, use simpler decision strategies, and make more use of easily available cues in judgements, decisions, and behaviour than under unconstrained conditions (e.g., Dijkster & Koomen, 1996; Kruglanski & Freund, 1983; Wright, 1974). Similar to low cognitive capacity (where enough processing time is given, but additional information has to be kept in working memory), constraints in processing time reduce the opportunity to engage in controlled processing. Implicit measures should better predict behaviour that occurs under processing-time constraints than relaxed behaviour. Evidence is consistent with this assumption.

In one study (Friese, Wänke, & Plessner, 2006), participants completed an IAT and self-report measures relating to brand-name and generic products. Later, they chose between two product arrangements that consisted of either brand-name or generic products. Of those participants with dissociated implicit and explicit preferences (i.e., implicitly preferring branded products, but explicitly preferring generic products, or vice versa), nearly all participants followed their explicitly measured attitude as long as they had ample time to make their decision. However, when placed under time pressure, more than 60% of participants followed their implicit preference.

Self-regulatory resources. In their model of self-regulation, Baumeister and colleagues assumed that the ability to self-control relies on a limited resource (e.g., Muraven & Baumeister, 2000). The exertion of self-control depletes this energy and leads to an increased influence of impulsive tendencies on subsequent behaviour. An impressive amount of supporting evidence for this model has been accumulated from diverse behavioural

domains such as eating, drinking, aggressive behaviour, and impulse buying (DeWall, Baumeister, Stillman, & Gailliot, 2007; Muraven, Collins, & Nienhaus, 2002; Vohs & Faber, 2007; Vohs & Heatherton, 2000). Active self-control impairs controlled processes and thereby the opportunity to control while leaving automatic processes unchanged (Govorun & Payne, 2006; Schmeichel, Vohs, & Baumeister, 2003). Consequently, implicit measures should predict behaviour better for participants depleted of self-regulatory resources than when resources are plentiful. Several studies support this prediction.

In three studies in the media and entertainment domain (Friese et al., 2008; Hofmann, Rauch, & Gawronski, 2007), participants completed an SC-IAT. Subsequently, half of the participants were depleted of self-regulatory resources by an emotion-suppression task (e.g., Baumeister, Bratslavsky, Muraven, & Tice, 1998) before engaging in a taste-and-rate task of a tempting food. In one of these studies, an SC-IAT predicted potato chip consumption in the condition with depleted self-regulatory resources, but not in the control condition, as expected. The opposite pattern was found for an explicit attitude measure (Friese et al., 2008, Study 2).

A study by Hofmann et al. (2007) used a similar procedure when predicting candy instead of potato chip consumption. However, instead of an explicit attitude measure they used dietary restraint standards (Pudel & Westenhoefer, 1989; Stunkard & Messick, 1985). Measures of restraint standards do not ask for an evaluation of a product, but for general nutrition strategies with questions about whether one occasionally stops eating despite being hungry or whether one avoids having a stock of tempting products at home. It is quite possible to like a certain product and yet to restrain oneself from consuming it (e.g., “I really like candy, but I want to keep a slim figure”). In line with expectations, the SC-IAT predicted candy consumption in a taste-and-rate task for participants with depleted resources, but not for those with full resources; dietary restraint standards showed the opposite pattern.

Finally, in a third study participants sampled two kinds of beer. An SC-IAT predicted beer consumption for participants with depleted resources, but not for those with full resources (Friese et al., 2008, Study 3). In this study both drinking restraint standards (Collins & Lapp, 1992; Cox et al., 2001) and explicitly measured attitudes towards beer contributed independently to the prediction of drinking behaviour in the control group with full resources, showing that the two constructs—while both drawing on control resources—are not only theoretically, but also practically distinct.

Mortality salience. Research on terror management theory has shown that individuals who are confronted with their own mortality initially suppress their thoughts about death or redirect their attention to other

topics (Greenberg, Pyszczynski, Solomon, Simon, & Breus, 1994; Harmon-Jones et al., 1997). Such controlled and effortful processes require self-regulatory resources (Gailliot, Schmeichel, & Baumeister, 2006), leading to an increased impact of impulsive tendencies on behaviour regulation. Implicit measures should predict behaviour better for participants who recently thought about their own death as compared to participants who thought about a control topic.

One study tested this assumption (Friese & Hofmann, 2008b). Half of the participants thought about their own death and half thought about a control topic. An SC-IAT relating to chocolate was not influenced by this manipulation with regard to SC-IAT effects or error rates. In line with expectations, the SC-IAT predicted chocolate consumption in a subsequent taste-and-rate task for participants in the mortality salience condition, but not in the control condition.

Alcohol. Alcohol impairs executive functions such as, among others, attentional processes, abstract reasoning, self-monitoring, and working-memory skills (e.g., Fillmore, Dixon, & Schweizer, 2000; Giancola, 2000; Hull & Slone, 2004). It mainly influences consciously controlled information processing while leaving automatic processes largely unchanged (Fillmore, Vogel-Sprott, & Gavrilescu, 1999). Hence, implicit measures should predict behaviour better for individuals who have consumed alcohol than for sober individuals. One study provides evidence for this assumption.

In this alleged market research study, an SC-IAT first assessed participants' automatic reactions to candy (Hofmann & Friese, 2008). Next, half of the participants drank a moderate dose of alcohol in a taste-and-rate task. After a filler task, participants consumed candy in a second product test before filling out a measure of eating restraint standards (Pudel & Westenhoefer, 1989; Stunkard & Messick, 1985). As expected, the SC-IAT predicted candy consumption for participants who had consumed alcohol, but not for sober participants. Conversely, eating restraint standards were associated with consumption only for sober participants.

Behavioural moderator pertaining to the opportunity to control

Controllability of behaviour. Nonverbal behaviours often lie outside conscious awareness. They are generally less controlled and less monitored than verbal behaviours (Crosby, Bromley, & Saxe, 1980, Harper, 1985), even though it is not impossible per se that they can be consciously controlled (DePaulo, 1992). Importantly, these are characteristics that describe different kinds of behaviours and not traits or states of the acting person. As compared to verbal behaviours, nonverbal behaviours are

assumed to be more strongly influenced by automatic processes (Crosby et al., 1980; Dovidio et al., 1997). Accordingly, implicit measures should be better at predicting nonverbal than verbal behaviours. Several studies found support for this hypothesis.

Dovidio et al. (1997, Study 3) used a subliminal concept priming measure to predict White American participants' nonverbal behaviours such as blinking and visual contact in an interaction with a Black and a White interviewer. As expected, explicit measures were unrelated to these behaviours but predicted a global evaluation of the interviewers that, in turn, was unrelated to the priming measure. In a similar study, Dovidio, Kawakami, and Gaertner (2002) found their priming measure to predict nonverbal friendliness, but not verbal friendliness. The opposite was true for explicit prejudice measures.

Research using an IAT relating to Caucasians versus African Americans corroborates these findings (Heider & Skowronski, 2007, Study 2). In this study, the IAT predicted Caucasians' nonverbal, but not verbal friendliness (both assessed as single global ratings) towards a Caucasian as compared to an African American confederate, even when controlling for explicitly measured attitudes.

Investigating behaviour related to shyness, Asendorpf et al. (2002) used an IAT for the implicit assessment and rating scales for the explicit assessment of the self-concept concerning shyness. Based on previous work (Asendorpf, 1990), the authors formed a priori defined indices of automatic (duration of facial and body adaptors and tense body posture) and controlled (duration of speech and illustrators) shy behaviours. As predicted, structural equation modelling revealed a relation between implicit measures and the index of automatic, but not controlled shy behaviours in a shyness-inducing situation in the laboratory. The explicit measure showed the opposite pattern.

In a study on spider phobia (Huijding & de Jong, 2006), participants completed an EAST (De Houwer, 2003) as an implicit measure of spider attitudes, a fear-of-spiders questionnaire (Muris & Merckelbach, 1996), and two behavioural measures of fear of spiders. The EAST predicted largely automatic eye blink startle responses to pictures of spiders, but it was unrelated to a more controlled measure of fear responding, the behavioural approach test (BAT, de Jong, Vorage, & van den Hout, 2000). During the BAT, participants are asked to approach a spider with increasing difficulty, from merely looking at the spider to letting it pass over their hands. The explicit measure showed essentially the opposite pattern.

In another study (Perugini, 2005, Study 2) participants completed an IAT and explicit measures relating to their attitudes towards and their regular consumption of fruit and snacks. At the end of the experiment participants picked either a fruit or a sweet snack from a variety of fruit and snacks that was presented in a big bowl. As expected, the IAT predicted this

spontaneous choice behaviour, but not the self-reported consumption behaviour that was presumably guided primarily by controlled processes. The opposite pattern of results emerged for the explicit measure.

Summary and discussion

The empirical evidence for the moderating role of opportunity to control is strong. Almost all reviewed studies across a variety of moderators revealed the expected pattern of increased predictive validity for conditions of low as compared to high opportunity to control. The findings extend to the distinction between hard- and easy-to-control behaviours.

As expected, the situational moderators lead to functionally equivalent effects. As a possible conceptual integration, we suggest that the common denominator of these moderators lies in the impairment of the central executive, which is responsible for information processing and the distribution of cognitive resources (Baddeley, 1990, 1996). To successfully fulfil its functions, the central executive is dependent on controlled processes. Time constraints, low cognitive capacity, low self-regulatory resources, and conditions after alcohol consumption are associated with less efficient controlled processing, whereas automatic processes are less affected by these conditions (Baddeley, 1996; Barrett et al., 2004; Fillmore et al., 1999; Govorun & Payne, 2006; Hull & Slone, 2004; Schmeichel et al., 2003). Thus, although the exact nature of the influence on the central executive varies, all moderators presented in the respective section impede its proper functioning. This weakening of central executive control opens the door to an increased influence of automatic processes in the guidance of behaviour and thus to the increased predictive validity of implicit measures.

Turning to “controllability of the behaviour”, one potentially problematic aspect of this moderator becomes apparent: An unambiguous classification into “controlled” and “uncontrolled” may be difficult to achieve for some behaviours, especially when controllability is not manipulated directly. Behaviours vary on a continuum of how controlled they usually are, which renders a dichotomous taxonomy more easily said than done. Furthermore, the degree of control may vary for any one behaviour between contexts. For example, the generally controllable behaviour of speaking time may be more likely to be controlled in a study on shyness (because participants see the relation of this behaviour to the topic of the study) while it may be less likely to be controlled in a study on prejudice (see Asendorpf et al., 2002, for details on this argument). Referring to this dilemma, Dovidio et al. (1997) suggested manipulating situational circumstances “that would permit or promote deliberative responding to varying degrees” (p. 532). Subsequent research followed this suggestion by situationally manipulating the opportunity or the motivation to control.

MODERATORS PERTAINING TO THE MOTIVATION TO CONTROL

A stronger motivation to control should lead to an enhanced impact of controlled processes on behaviour (Chaiken & Trope, 1999; Smith & DeCoster, 2000). Thus, implicit measures should better predict the behaviour of individuals who are dispositionally or situationally weakly (as compared to highly) motivated to control their behaviour. The same prediction holds for behaviours that are carried out without much thinking as compared to those that motivate an actor to control. The moderators reviewed in this section are depicted in the middle column of Table 1.

Dispositional moderators pertaining to the motivation to control

Motivation to be egalitarian. Earlier, we presented two studies by Dasgupta and Rivera (2006) that found moderator effects of the control over nonverbal behaviour on the predictive validity of gay–heterosexual IATs with regard to nonverbal behaviour towards a presumably gay confederate. In these studies the researchers also included a measure of the motivation to be egalitarian (e.g., a scale assessing the degree to which people endorse traditional prescriptive gender norms and the degree to which people are invested in emphasising their heterosexual identity). Results showed that the correlation between implicit prejudice and negative nonverbal behaviour was stronger for participants both low in motivation to be egalitarian and low in behavioural control. Implicit prejudice was unrelated to nonverbal behaviour for participants with a high motivation to be egalitarian. These results are not strictly in line with dual-process models, because these models typically assume that automatic processes are important in behaviour execution if either opportunity *or* motivation to control is lacking. In the studies by Dasgupta and Rivera (2006), behavioural control was enough to prevent implicit prejudice from translating into behaviour even for participants with a low motivation to be egalitarian.

Need for cognition (NFC). NFC is the dispositional motivation to engage in and enjoy effortful cognitive processing (for an overview, see Cacioppo, Petty, Feinstein, & Jarvis, 1996). NFC is a general construct in the sense that it pertains to any domain of reasoning, as opposed to more content-specific motivations to engage in effortful processing, such as the motivation to control prejudiced reactions (Dunton & Fazio, 1997). The more information is carefully processed, the smaller should be the weight of automatic processes in behaviour determination. Compared to individuals high in NFC who engage in extensive information processing, individuals low in NFC should engage in less information processing and trust their

automatically activated associations more as a basis for their behaviour. Consequently, implicit measures should predict behaviour better for individuals low as compared to high in NFC.

We are not aware of any studies showing a moderating role of NFC in observed behaviour, but there is one study of NFC and social judgements (Florack, Scarabis, & Bless, 2001). In this study, German participants completed an IAT on Turks versus Germans. Then they read a fictitious newspaper article describing a juvenile Turkish offender and later judged this target person on a number of dimensions. Finally, they filled in a measure of NFC (Bless, Wänke, Bohner, Fellhauer, & Schwarz, 1994; Cacioppo & Petty, 1982). As expected, the IAT was positively related to these judgements only for participants who were low in NFC.

In contrast to these results, NFC failed to moderate the relation between implicit measures and behaviour in two other studies (Conner, Perugini, O’Gorman, Ayres, & Prestwich, 2007). In this research participants completed an IAT and an EAST on sweets (Study 1) or an IAT on chocolate versus fruit (Study 2). They also completed explicit measures, a shortened measure of NFC (Epstein, Pacini, Denes-Raj, & Heier, 1996), and a food diary over the course of the following week. In Study 2 they additionally chose either a piece of fruit or a chocolate bar at the end of the session. NFC did not moderate the relationship between any implicit measure and any criterion variable. However, it moderated the relationship between the explicit measures and the self-reported sweets consumption with higher attitude–behaviour consistency for participants high in NFC.

We can only speculate about the reasons for these mixed results. Conner et al. (2007) based their analysis on only 4 items of the 19-item scale (Epstein et al., 1996), and the degree of convergence with the full scale remains unclear. Also, Conner et al. (2007) used the English version of the scale while Florack et al. (2001) drew on the German version (Bless et al., 1994). In addition, the studies differed with regard to conceptual aspects such as the use of judgements versus self-reported behaviour as criterion variables. Further research should address these points systematically.

Motivation to control prejudiced reactions (MCPR). MCPR is the motivation to avoid prejudiced judgements and behaviours (Dunton & Fazio, 1997). The scale to assess this construct consists of two largely independent factors: “concern with acting prejudiced” and “restraint to avoid dispute”. The scale has mostly been used with respect to Whites’ reactions to Blacks.

We are not aware of any studies showing MCPR to moderate the predictive validity of an implicit measure with respect to real behaviour (but see Gabriel, Banse, & Hug, 2007 for a person \times situation interaction discussed later). Therefore we present one study that investigated social

judgements as an example. In separate sessions, Olson and Fazio (2004a) had participants complete the MCPR and an evaluative priming procedure (Fazio et al., 1995) on automatically activated attitudes about Blacks. In a third session participants made trait inferences about people who were presented to them on a computer screen. The evaluative priming successfully predicted the impressions formed about Black target persons, but only for participants scoring low on the restraint factor of the MCPR. Participants scoring high on the restraint factor showed the opposite pattern, such that more negative automatically activated attitudes were associated with more positive judgements. The authors interpreted this finding as an overcorrection process by the participants scoring high on the restraint factor.

Situational moderators pertaining to the motivation to control

Hedonic need states. Sometimes people experience tempting situations that may strongly compromise their motivation to deliberate before acting. For instance, even though most people clearly value the advantages of condoms with regard to birth control and protection from sexually transmitted diseases (Fisher, Fisher, & Rye, 1995), people often refrain from using them “in the heat of the moment”. Marsh, Johnson, and Scott-Sheldon (2001) reasoned that, as compared to having sex with a steady partner, the opportunity to have sex with a casual partner creates particularly strong hedonic need states that undermine the motivation to deliberate. Consequently, implicit measures should predict condom use better in sexual situations with a casual partner as compared to a steady partner.

To test this hypothesis Marsh and colleagues (2001) employed several implicit measures in order to predict self-reported condom use, an affective priming procedure (Fazio et al., 1986), a self-concept IAT, and an evaluative IAT. Participants also completed explicit attitude measures. As expected, the evaluative IAT tended to correlate with condom use with a casual partner, but was unrelated to condom use with a steady partner. The affective priming measure, however, was unrelated to condom use with a steady partner, and, unexpectedly, tended to correlate negatively with condom use with a casual partner. Finally, the self-concept IAT was unrelated to condom use in both situations. In contrast, explicit attitude measures predicted condom use with a steady, but not with a casual, partner. Taken together, these findings offer first support for the idea that hedonic need states may foster the influence of automatic processes on behaviour. At the same time, the findings are inconsistent with regard to the implicit measures employed. This may be due to low reliabilities and a fairly complex experimental design in the study by Marsh and colleagues. Further research is needed on the moderating role of hedonic need states.

Social control. The higher the social control (i.e., the behaviour is performed while being observed by another person vs privately) in a given situation, the higher the motivation to carefully monitor one's behaviour should be (Schlenker, Britt, & Pennington, 1996), which in turn should go along with decreased predictive validity of implicit measures. Gabriel et al. (2007) investigated helping behaviour as a function of a private or public setting that was established through the absence or presence of the experimenter during the critical behaviour (i.e., signing a petition and donating money to a local gay organisation at the end of the study). The authors used an IAT as an implicit measure and evaluative rating scales as well as a measure of the MCPR (Banse & Gawronski, 2003; Dunton & Fazio, 1997) as additional predictors. Generally, the authors expected a homosexuality IAT to predict these helping behaviours for participants with a weak MCPR, but not for those with a strong MCPR. They had no specific hypothesis about a possible three-way interaction with the social setting but explored several possibilities including an enhanced or attenuated IAT \times MCPR interaction in the private as compared to the public setting.

None of these possibilities fully matched the empirical pattern. The authors found a person \times situation interaction between the IAT and MCPR in the public but not in the private setting. In this interaction, more highly positive IAT scores led to more helping behaviour for participants with low MCPR. Unexpectedly, participants with high MCPR showed the opposite pattern: less helping behaviour with increasingly positive IAT scores. If anything, the authors had expected an "upward" correction in the sense of more helping behaviour for participants high in MCPR and positive IAT scores. However, a "downward" correction emerged. In the private setting, where social control and normative pressure was low, neither the IAT nor MCPR nor their interaction term significantly predicted helping behaviour. Gabriel et al. (2007) discussed several theoretical explanations, but none can account for this complex and unexpected pattern. The authors advised that their findings should not be "over-interpreted". They suspected several methodological limitations of their study to be responsible for this pattern. Clearly, more research is needed on social control as a moderator.

Summary

Theory-affirming evidence concerning the moderating role of motivation to control is scarce. Few studies investigated this determinant of moderation with regard to real behaviour. Studies investigating different kinds of behaviour as a moderator are missing. In sum, more studies on motivational moderators are desirable.

MODERATORS PERTAINING TO DIFFERENCES IN PROCESS RELIANCE

As was shown in the preceding two sections, differences in the opportunity or the motivation to control affect the reliance on automatic versus controlled processes. That is, the effects of all moderators reviewed up to this point were presumably brought about by differences in opportunity or motivation to control. However, other factors may directly lead to a reliance on automatic or controlled processes without depending on variance in opportunity or motivation (Smith & DeCoster, 2000). We therefore suggest a third determinant to account for such moderators (see right column in Table 1). Greater reliance on automatic as compared to controlled processes should lead to higher predictive validity of implicit measures.

Dispositional moderators pertaining to process reliance

Preference for intuition. Preference for intuition describes the dispositional tendency to rely on affective inner reactions in decision making (Betsch, 2004; Epstein et al., 1996). Corroborating the classification of this moderator to the determinant of process reliance, Betsch (2004) noted that the preference for intuition scale (Betsch, 2004) assesses “... a preference for affective decision making, *independently of the ability or motivation* to use different cognitive strategies” (p. 191, translation and emphases added by the authors). Substantiating this claim, preference for intuition correlated only $-.12$ with NFC (Epstein et al., 1996) in a validation study (Betsch, 2004). Thus, the construct is not merely the opposite of an increased motivation to control, as might be suspected. Since implicit measures are assumed to primarily tap into affective associations (Gawronski & Bodenhausen, 2006, 2007; Hofmann, Gawronski, Gschwendner, Le, & Schmitt, 2005), they should predict behaviour better for individuals high as compared to low in preference for intuition.

One study in the domain of moral judgement supports this assumption (Hofmann & Baumert, 2007). In this study, participants received an unfair offer to split money between an ostensibly second participant and themselves in an ultimatum game (e.g., Camerer & Thaler, 1995). In an independent session their automatic affective reactions to moral stimuli (e.g., burglary, drunk driving, emergency aid, or home care) were assessed with an affect misattribution procedure (AMP; Payne et al., 2005). Participants also completed the preference for intuition measure (Betsch, 2004). As expected, the degree to which moral stimuli elicited congruent affective reactions in the AMP predicted the probability of rejection of the unfair proposal for participants high in preference for intuition but not for those low in preference for intuition.

Chronic regulatory focus. Regulatory focus theory (Higgins, 1997, 1998) suggests a distinction between ideals (hopes, wishes, aspirations) and oughts (obligations, duties, responsibilities). Ideals and oughts tap into two distinct self-regulatory systems: ideals into a promotion system and oughts into a prevention system. Although both systems exist in every individual, one system may be chronically or situationally more accessible than the other. Importantly, the two systems are associated with different information-processing strategies. A promotion focus fosters lower-order information processing and the reliance on inner cues such as affective responses. In contrast, a prevention focus fosters controlled information processing and the reliance on external cues (Pham & Avnet, 2004). Crucially for the classification as a moderator of process reliance, Pham and Avnet (2004) showed that the reliance on different information-processing strategies is not caused by different motivations to control. Based on these different information-processing strategies, it can be hypothesised that implicit measures should predict behaviour better for individuals with a chronic promotion focus than for those with a chronic prevention focus.

We are not aware of any studies that have tested this prediction with regard to real behaviour. Therefore we present one study that included behavioural intentions as the criterion variable (Florack, Scarabis, & Gosejohann, 2004, cited in Florack, Scarabis, & Gosejohann, 2005). In this study participants saw an advertisement for a Whopper or a Big Mac and indicated their purchase intention. Automatic product preferences for the burgers were measured with an IAT and the chronic regulatory focus with a questionnaire (Lockwood, Jordan, & Kunda, 2002). As expected, automatic product preferences correlated more highly with purchase intentions for participants with a chronic promotion focus than for those with a chronic prevention focus.

Situational moderators pertaining to process reliance

Affective/cognitive focus. When people focus on their affective reactions to target objects, automatic processes gain influence in guiding behaviour (Shiv & Fedorikhin, 1999; Wilson & Schooler, 1991). Implicit measures are assumed to primarily assess automatic, affective reactions (Gawronski & Bodenhausen, 2006, 2007; Hofmann et al., 2005). As a consequence, implicit measures should better predict behaviour that is based on affective as compared to cognitive aspects.

One study tested this assumption by situationally manipulating the accessibility of participants' affective or cognitive reactions to target objects (Scarabis et al., 2006). The higher the accessibility of a construct, the greater the chance that it will be used to guide subsequent behaviour (Fazio & Towles-Schwen, 1999; Stapel & Tesser, 2001; Strack & Deutsch, 2004).

Participants were to choose between a chocolate bar or a piece of fruit. They were instructed either to think about which option would make their mouth water more (affective focus condition) or to analyse their choice and to list several arguments for their preferred option (cognitive focus condition). As expected, an evaluative as well as a self-concept IAT relating to fruit and chocolate predicted choice behaviour better for participants in the affective focus than in the cognitive focus condition. Presumably, opportunity and motivation to control did not differ between conditions as all participants spent an equal amount of time in concentrated thought about affective or cognitive aspects, respectively, and their cognitive resources were not manipulated. Rather, differences in predictive validity were obtained by more directly influencing the reliance on automatic or controlled processes to guide behaviour.

Mood. Independent from their affective or cognitive reactions to specific target objects, individuals may differ more generally in their mood states. Individuals in a positive mood engage in more shallow information processing than individuals in a negative mood. Specifically, they rely more heavily on their associative network in information processing (Bolte, Goschke, & Kuhl, 2003; Isen, Johnson, Mertz, & Robinson, 1985) and make more use of general-knowledge structures such as heuristics, stereotypes, or scripts (e.g., Bless & Schwarz, 1999; Bodenhausen et al., 1994). Different accounts have been proposed to explain these findings, including reduced opportunity or motivation to control due to a positive mood (Isen, 1987; Schwarz, 1990; for a review, see Bless & Schwarz, 1999). Crucially for the classification of mood as a moderator of process reliance, Bless and colleagues showed that reduced opportunity and motivation to control are sufficient, but not necessary conditions for typical mood effects to occur (Bless et al., 1996a, 1996b). In other words, positive mood may lead to a reduced motivation to process in some situations (in which case, mood would function as a motivational moderator), but many times people in a positive mood rely on associative structures in information processing *independently* of changes in opportunity or motivation to control (Bless, 2000, 2001; Bless & Schwarz, 1999). Consequently, implicit measures should predict behaviour better for individuals in a positive mood than for individuals in a negative mood.

In a series of studies, Hermsen, Holland, and van Knippenberg (2006) investigated this hypothesis. In Study 1, an IAT of two political parties predicted the seating distance that participants left between themselves and two posters of the respective parties in a waiting room for participants in a positive mood, but not for those in a negative mood. An explicit attitude measure predicted this rather unintended behaviour in neither condition.

In Study 2a, an SC-IAT on blood donation predicted how much information participants provided on a form asking for their interest in

becoming a blood donor. Again, this predictive validity occurred only for participants in a positive mood. In a third study a personalized IAT (Olson & Fazio, 2004b) predicted the choice between an apple and a candy bar for participants in a positive mood, but not for participants in a negative mood. A final study replicated this effect with participants whose attitudes were measured both implicitly and explicitly.

Situational regulatory focus. As in the case of chronic regulatory focus (see above), a situationally induced promotion focus leads people to endorse a lower-order processing style, including reliance on inner cues such as affective responses. People with a situationally induced prevention focus endorse a higher-order processing style, including reliance on external cues (Pham & Avnet, 2004). Crucially, this difference in processing styles is not due to differences in motivation to control. Nor does it go along with differences in mood (Pham & Avnet, 2004). Rather, the crucial factor seems to be the reliance on different types of information (internal vs external; Florack et al., 2005). Implicit measures should predict behaviour better for participants in a promotion focus than for those in a prevention focus.

Two alleged market research studies support these hypotheses. In one study (Florack, Friese, & Scarabis, 2008, Study 2), participants' regulatory focus was manipulated by asking participants to think about their aspirations and hopes (promotion focus condition) versus their duties, obligations, and responsibilities (prevention focus condition; Higgins, Roney, Crowe, & Hymes, 1994). A self-concept IAT relating to chocolate and fruit predicted a choice between these two options better for participants in a promotion than in a prevention focus.

In another study (Florack et al., 2008, Study 3), participants first completed an evaluative SC-IAT relating to potato chips. To manipulate their regulatory focus, participants were instructed to count their correct responses (promotion focus condition) or errors (prevention focus condition) in a speeded concentration task (Brickenkamp, 1962). Additionally, participants were told that they would receive a cup (promotion) or would have to give back a cup they had received earlier (prevention) if they met (promotion) or did not meet (prevention) a certain performance criterion on the concentration task (Florack, Ineichen, & Bieri, in press). Later, participants tasted and rated a bag of potato chips in a presumed product test. As expected, the SC-IAT predicted potato chips consumption, but only for participants in a promotion focus. The moderating role of regulatory focus thus emerged for different implicit measures (IAT, SC-IAT) assessing different kinds of associations (self-concept, evaluative).

Construct activation affecting the validity of the measurement outcome. Activation of certain knowledge structures in the associative

network leads to a heightened accessibility of these structures without requiring conscious awareness. This heightened accessibility can influence information processing and the respective constructs will more likely be captured by implicit measures (Fazio & Towles-Schwen, 1999; Strack & Deutsch, 2004). Perugini, O’Gorman, and Prestwich (2007) reasoned that an IAT that is performed directly after a manipulation that activates the self should encompass more “valid variance” (p. 135); that is, more self-related cognitions in the associative network, which should be reflected in increased predictive validity. Three studies support this assumption.

Self-activation was manipulated by methods introduced by Brewer and Gardner (1996; “Circle all self-relevant words in a text”) or Silvia (2002; “Describe what makes you unique as an individual”). Several self-reported behaviours served as criterion variables, namely the relative preference for drinking alcohol over soft-drinks (Study 1), the academic programme participants were enrolled in at a university (arts vs sciences, Study 2), and consumption of junk food versus healthy food (Study 3). IATs that were performed directly after a manipulation of self-activation achieved higher predictive validity than IATs that were performed after a control manipulation in predicting these behaviours.

Construct activation affecting the execution of behaviour. The activation of a construct may also affect behaviour execution directly (Moskowitz, Li, & Kirk, 2004; Stapel & Tesser, 2001). Several authors reasoned that individuals will more likely rely on their automatic associations towards a construct if this construct has been activated prior to behaviour execution. Following this reasoning, implicit measures should predict construct-related behaviours better after a prior activation of this construct as compared to control conditions. This idea has been tested with regard to two different types of constructs, stereotypes and goal states.

In one study (Perugini & Prestwich, 2007), British participants first completed an Americans–Australians IAT before being primed with the stereotype of Americans or neutral words. Next, they read an essay ostensibly written by an American person. The more positive the IAT score for Americans relative to Australians, the more positive was the evaluation of the essay quality. As predicted, this was only true in the condition in which the American stereotype had been primed.

In another study (Custers & Aarts, 2007, Study 2), half of the participants were subliminally primed (Aarts et al., 2005) with the goal state “socialising”. Afterwards, they learned that at the end of the study they had the chance to enter a lottery for tickets for a student dance-party (a behaviour relevant to the focal goal state), but only if enough time remained after the next task. This was a mouse-click task (Aarts, Gollwitzer, & Hassin, 2004) intended to measure the effort participants invested in goal

pursuit. After a filler task participants completed an EAST assessing evaluative associations with the goal state “socialising” in an ostensibly separate experiment. As predicted, more positive associations to the goal state were associated with increased effort on the mouse-click task (working faster), but only when the goal state had been primed.

Uncertainty. When people are confronted with a decision, but have difficulty making up their mind on the basis of reflective thinking about the available arguments, they may draw on their implicit dispositions to a greater extent than those who are already decided. In particular, research suggests that automatic associations may affect information processing such that future decisions will be in line with these automatic associations (Gawronski, Geschke, & Banse, 2003). Implicit measures should thus predict behaviour better for individuals who are uncertain than for those who are decided.

In one study (Galdi, Arcuri, & Gawronski, 2008), Italian participants were asked whether they were in favour, against, or undecided about the potential enlargement of a US military base in their region. Participants also completed an evaluative SC-IAT relating to this military base and an explicit measure. At the end of the study they were provided with some arguments for either side of the discussion and asked to think about the issue. The SC-IAT predicted participants’ choice (in favour, against, undecided) 1 week later for those who indicated that they were uncertain about the decision in the first session. It was unrelated to choice behaviour for decided participants. The explicit measure showed the opposite pattern.

Behavioural moderator pertaining to process reliance

Habitualness. The more a behaviour becomes habituated, the more automatic and less controlled it becomes (e.g., Aarts & Dijksterhuis, 2000; Logan, 1988; Verplanken & Aarts, 1999). That is, the individual needs to exert less effort on behaviour regulation and relies more on automated procedures. Importantly, this can occur independently of any dispositional or situational factors, but it is a characteristic of the behaviour itself. Consequently, implicit measures should better predict habituated behaviour than behaviour that requires effortful regulation. Evidence supports this reasoning.

In their studies on the moderating role of NFC described above, Conner et al. (2007) also included a measure of habitualness regarding eating sweets (Verplanken & Orbell, 2003) that assessed how automated this behaviour is. In Study 1 the predictive validity of an EAST for self-reported eating behaviour was greater for participants with higher habitualness in eating sweets than for participants scoring low on this index. No moderation effect occurred for an IAT that used geometric shapes as the contrast category to sweets. In Study 2 a fruit versus chocolate IAT predicted self-reported

consumption and the choice between a piece of fruit and a chocolate bar better for participants who reported consuming sweets habitually than for other participants.

Summary

There is substantial and consistent evidence for moderating factors that increase reliance on automatic or controlled processes without necessarily being caused by variance in opportunity or motivation to control. As expected, reliance on automatic processes is associated with increased predictive validity of implicit measures.

DISCUSSION

In this chapter we reviewed the empirical evidence for moderators of the predictive validity of implicit measures provided by more than 45 studies. To this end, we drew on dual-process models (Chaiken & Trope, 1999; Smith & DeCoster, 2000) to structure the evidence along theoretically meaningful lines. On a first classification dimension, we deduced two determinants of moderation from these models: opportunity and motivation to control. In addition we suggested a third determinant: direct reliance on automatic processes that is not brought about by differences in opportunity and motivation to control. A second dimension that was orthogonally crossed with the first differentiated whether a moderator pertained primarily to a disposition of the acting person, to situational influences, or to the behaviour itself. The general picture drawn by the reviewed studies corroborates the assumptions. Lower opportunity to control is associated with higher predictive validity of implicit measures, as is a lower motivation to control, although the results are less consistent with regard to motivation. In addition, reliance on automatic processes independent of changes in opportunity or motivation increases the predictive validity.

Several dual-process models integrate the possibility that factors other than opportunity and motivation may lead to a reliance on either automatic or controlled processes (e.g., Epstein, 1994; Smith & DeCoster, 2000). The determinant process reliance integrates these factors into the classification system. It is also compatible with other dual-process models. The proposal that changes in opportunity and motivation to control shift the relative weight of automatic and controlled processes does not logically imply that shifts in the relative weights *need* to be caused by changes in opportunity and motivation. In fact, most models do not make such a claim. Instead, they merely state that changes in opportunity and motivation are sufficient (as opposed to necessary) to cause these shifts (Bless & Schwarz, 1999). Although the studies presented in the section on process reliance offer some

first impressions of this determinant, it is desirable for future models to more specifically outline the conditions under which individuals will make use of direct process reliance.

In the remainder of this discussion we will first discuss assets and limitations of the classification system of moderators. Next we will outline possible avenues for future research before discussing implications of the present studies for research on self-regulation.

The classification system

In this review we focused on moderators that affect the information processing of individuals by shifting the relative weights of automatic and controlled processes. We think that the classification system does a good job of structuring the empirical evidence in theoretically telling terms. Besides, it allows for the identification of general moderator concepts for which the empirical evidence is particularly strong. For example, in the first column in Table 1, the concept cognitive capacity may be conceptualised as a disposition (low working memory capacity, row 1) or as a situational characteristic (low cognitive capacity, row 2). A similar point can be made for chronic and situational regulatory focus in the column of process reliance.

We classified each moderator uniquely to one of the three determinants according to its predominant mode of functioning. However, this classification does not preclude that facets of another determinant may play a role in the functioning of a given moderator. For example, we classified hedonic need states (e.g., having sex with a casual vs a steady partner) as a motivational moderator because in such situations the motivation to form deliberate intentions may be undermined. This notwithstanding, having sex with a casual partner could also go along with unusually high arousal that diminishes the resources available for controlling behaviour. In a similar vein, it can be argued that alcohol not only impairs controlled information processing (e.g., Fillmore et al., 1999; Giancola, 2000), but that it may also undermine the motivation to control and bring behaviour in line with personal and societal standards (Baumeister, Heatherton, & Tice, 1994; Hull & Bond, 1986). The intoxication could function as an excuse for impulsively driven behaviour.

On a more general level, a clear distinction between the influences of opportunity and motivation may be difficult in many instances as opportunity and motivation are likely to interact in various ways to affect the processing intensity of individuals (for an example, see Dasgupta & Rivera, 2006, discussed above). For example, someone who is poorly motivated to perform a certain task may distract herself from the task and subsequently lack the opportunity for controlled processing due to the

distraction that draws on resources. Proposing another interaction pattern, recent research suggests that a temporary depletion of self-regulatory resources leads people to conserve their remaining resources (Muraven & Slessareva, 2003). Provided with a sufficient motivation, they may overcome this depletion at least temporarily and self-control just as well as individuals with full resources (Martijn et al., 2007; Webb & Sheeran, 2003). These examples make it apparent that in many situations it is a difficult call as to which determinant—opportunity or motivation—is primarily responsible for the increased impact of automatic processes, as both determinants may interact and contribute jointly to the effect.

Despite ambiguities that may arise under certain conditions, we deem it useful to classify the moderators according to their predominant determinant. Such a classification system helps to organise the literature and inspires new research questions. Such benefits are not lessened if the classifications for individual moderators are not set in stone for all possible conditions.

The focus on moderators that affect the information processing of individuals implies that other possible moderators are not captured by the classification system. For example, the reliability of the implicit measure, the correspondence between the implicit measure and the behaviour (Ajzen & Fishbein, 1977; Gschwendner, Hofmann, & Schmitt, 2008b), or the proximity of implicit and behavioural measures (Richetin & Perugini, 2008), constitute plausible methodological moderators. Some of these moderators have been tackled in the meta-analysis by Greenwald et al. (in press).

Avenues for future research

The classification system highlights those areas that have received varying amounts of attention from researchers in the past. Thereby, it allows for the derivation of hypotheses involving additional moderators. We will outline only a few; the list could easily be extended.

First, until now evidence has been scarce for situational manipulations that would motivate people to deliberately engage in more or less controlled processing, which should result in moderated predictive validity of implicit measures. We suggest that telling people that they will have to explain and justify their behaviour later will foster their motivation for controlled processing (Lerner & Tetlock, 1999), leading to decreased predictive validity of implicit measures. In contrast, situations of (perceived) absolute anonymity that make it appear obvious to participants that their reactions cannot be traced back to them personally should reduce the motivation to control and thereby increase the predictive validity of an implicit measure. One example would be deindividuation; that is, behaviour that occurs under

the protection of a large group, in which individual responses seemingly cannot be identified.

Second, the only cell in our classification system for which empirical evidence is still missing pertains to behavioural moderators of the motivation to control (second column, third row in Table 1). Following the reasoning from the above paragraph, behaviours that a person will be held responsible for should be carried out with more control than behaviours for which a person is not accountable. Note that the characteristic of accountability may be manipulated situationally as suggested. However, it may also be a characteristic of a behaviour, independent of dispositional or situational characteristics (e.g., writing a private diary vs a letter). Similar arguments can be made for behaviours that a person is either hardly or highly involved in, or that underlie strong versus weak norms, and so forth.

Beyond inspiring the search for new moderators, hypotheses may be developed about synergistic effects of several moderators (see Gabriel et al., 2007, for one example). Such synergistic interaction effects may result from either a combination of different determinants (opportunity, motivation, process reliance) within the same entities (disposition, situation, behaviour), or from a combination of entities within one determinant, or a combination of both different determinants and different entities. For example, a particularly strong motivation to control should counteract influences of reduced opportunity to control (e.g., Martijn, Tenbült, Merckelbach, Dreezens, & de Vries, 2002; Webb & Sheeran, 2003). That is, the predictive validity of implicit measures should be higher under conditions of low opportunity, but more so for individuals with a low rather than a high motivation to control.

From an applied perspective it would be desirable to find out more about the boundary conditions and how to optimise the set-up of a given measure for a specific research question. Remarkably, some implicit measures predicted behaviour over a time span of 2 weeks and more (Hermsen et al., 2006; Hofmann et al., 2008a, 2008b), lending further support to the notion that implicit measures in part capture stable variance (Schmukle & Egloff, 2004). On the other hand, several studies show that implicit measures are sensitive to changes in context (e.g., Blair, 2002), procedural elements (e.g., Bluemke & Friese, 2006), and need states (Seibt, Häfner, & Deutsch, 2007). More research is needed to find out if and how these changes in mean effects translate into altered stability (Gschwendner, Hofmann, & Schmitt, 2008a) and predictive validity (Bluemke & Friese, 2008).

In a related vein, more research is needed on the interrelations of the various implicit measures in order to extend the scarce theoretical and empirical evidence in this area (for notable contributions see Bosson, Swann, & Pennebaker, 2000; Brauer, Wasel, & Niedenthal, 2000;

Cunningham, Preacher, & Banaji, 2001; De Houwer, 2003; Rudolph, Schröder-Abé, Schütz, Gregg, & Sedikides, 2008). The majority of the reviewed studies used an IAT measure or a derivative of this procedure, such as the SC-IAT or the EAST; some relied on evaluative priming, semantic priming, or the AMP. However, studies directly comparing the ability of these measures to predict different kinds of behaviour are desirable, but rare (for exceptions, see Conner et al., 2007; Marsh et al., 2001; Spruyt, Hermans, De Houwer, Vandekerckhove, & Eelen, 2007). For example, it is plausible to assume higher predictive validity for an SC-IAT as compared to a standard IAT when it comes to predicting consumption of *one* certain substance. It is unclear how an arbitrarily chosen contrast category in a standard IAT could improve the predictive validity, leading to a relative preference index of one target category over the other. However, this reasoning remains untested to date.

Another avenue in research may lie in a close investigation of the processes affecting the measurement outcomes of implicit measures. Although implicit measures are chiefly influenced by automatic processes, recent research suggests that they are also, albeit to a lesser extent, influenced by controlled processes (Conrey et al., 2005; Payne, 2005; Sherman et al., 2008; see also Klauer, Voss, Schmitz, & Teige-Mocigemba, 2007). One could argue that after a separation of these processes, automatic components should better predict behaviour under conditions that foster the reliance on automatic processes (see Gonsalkorale, von Hippel, Sherman, & Klauer, 2009). A conflicting hypothesis would build on the idea that even though the relative weights of automatic and controlled processes vary in behaviour determination as a function of certain boundary conditions, no behaviour is uniquely influenced by one kind of process (e.g., Fazio, 1990; Smith & DeCoster, 2000; Strack & Deutsch, 2004). Therefore measurement outcomes reflecting both automatic and controlled processes may be superior. The crucial aspect seems to be the optimal match between the mixtures of automatic and controlled processes on (a) the side of the measurement outcome and (b) the behaviour that one wants to predict (De Houwer, 2006).

Implications for self-regulation research

The studies presented in this chapter as a whole are quite diverse as they cover numerous moderators and behaviours. A closer look at this diversity reveals that the social situations in many of these studies can be framed as self-regulatory challenges for the participants. Dual-process models provide a theoretical framework for such an approach (Epstein, 1994; Metcalfe & Mischel, 1999; Strack & Deutsch, 2004; see also Carver, 2005). Most of the reviewed studies describe conflicts between automatic

reactions to stimuli (e.g., an automatic attraction to potato chips) and more controlled processes that are based on an individual's goals, standards, and explicit evaluations (e.g., "I want to lose weight"). A prerequisite for varying predictive validities of implicit and explicit measures is that the reactions that are activated by the different kinds of processes that these measures are intended to measure differ in the first place. Only if this is the case can implicit and explicit measures show differential predictive validity.

A great amount of research on self-regulation has investigated factors that influence the ability to self-control in certain situations (e.g., Metcalfe & Mischel, 1999; Muraven & Baumeister, 2000), or chronic individual differences in self-regulatory strength (e.g., Brandon, Oescher, & Loftin, 1990; Tangney et al., 2004). A basic assumption in this literature is that the lower the available control resources, the higher the impact of automatic, impulsive tendencies on behaviour. However, this assumption is rarely tested directly. Rather, it is inferred indirectly from mean differences between groups with situationally or chronically low resources (e.g., more consumption of a tempting food by individuals with low resources; e.g., Baumeister et al., 1998; Muraven et al., 2002; Shiv & Fedorikhin, 1999, Vohs & Heatherton, 2000). In these studies, impulse strength has been seen as a constant ("Everybody is keen on potato chips and equally so"), and individual differences in impulse strength have been treated as error variance (see Herman & Polivy, 2004, for a related view). Similarly, measures to assess controlled processes (such as explicit attitudes or personal standards) have rarely been taken into account. However, it is conceivable that people differ in their impulses and in their controlled dispositions that influence behaviour. The studies reviewed here add a dynamic component to research on self-regulation by assessing individual differences in automatic and controlled dispositions. This approach allows for a more precise prediction of behaviour than if any of these facets is studied in isolation (Friese, Wänke, & Hofmann, in press).

In a recent article, Baumeister and colleagues (2007, see also Patterson, 2008) put forward a dedicated claim for more psychological research featuring real behaviour. We wholeheartedly agree with this claim. Unfortunately, as Baumeister et al. note, "... the sad fact is that many studies [including real behaviour] fail to show meaningful significant differences" (p. 12). As a consequence, many researchers may be discouraged from conducting laborious studies with real behaviour because non-significant results are difficult to publish. Interestingly, in several of the studies using real behaviours that we reviewed in this chapter, no significant mean differences emerged between experimental conditions. For example, in their study on the effects of cognitive capacity on choice behaviour between fruit and chocolate bars, Friese et al. (2008, Study 1) found no significant difference in the number of chocolate bars chosen between conditions. In the

absence of individual difference measures of automatic and controlled processes, researchers would often have to conclude that the disposition or the situational manipulation under investigation had no effect on behaviour regulation. However, in the presence of such measures, the studies reviewed here found direct support for dual-process models and models of self-regulation (e.g., Muraven & Baumeister, 2000) by measuring the processes that are assumed to drive behaviour under different conditions and by showing that these measures differentially predict behaviour as a function of opportunity, motivation, and process reliance. Through the use of such a measurement approach, researchers are not dependent on mean differences between groups in order to show varying influences of automatic and controlled processes on behaviour. They are thus less susceptible to the danger of prematurely concluding that their manipulations were ineffective.

Conclusion

Following controversies in the last century over the question of whether personality traits and attitudes predict behaviour (e.g., Mischel, 1968; Wicker, 1969), researchers turned to the question of what moderates this relationship; that is, when traits and attitudes will or will not predict behaviour (e.g., Kenrick & Funder, 1988, Zanna & Fazio, 1982). The field of implicit social cognition research is currently in the midst of such a cycle of questions regarding the predictive validity of implicit measures. A large number of studies show that implicit measures indeed do predict behaviour (Fazio & Olson, 2003; Greenwald et al., in press). The present review provides some first answers to the questions of *when* they will be more or less likely to successfully do so, and *how*—that is, by what kind of processes—this predictive validity is brought about. Implicit measures will primarily predict behaviour under conditions of low opportunity or motivation to control, or when individuals rely on automatic processes to guide their behaviour for any other reason.

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APPENDIX: Overview of empirical findings on the moderation of predictive validity of implicit measures. The order of studies in the table refers to the sequence in which they are presented in the text.

<i>Moderator</i>	<i>Study</i>	<i>Behaviour</i>	<i>Implicit measure (s)</i>	<i>Central findings</i>
Working memory capacity	Hofmann, et al., 2008b, Study 1	Relative viewing time of erotic vs arts pictures	SC-IAT	IM predicts viewing time better for participants low in working memory capacity than those high in working memory capacity
	Hofmann et al., 2008b, Study 2	Candy consumption	SC-IAT	IM predicts consumption better for participants low in working memory capacity than those high in working memory capacity
	Hofmann et al., 2008b, Study 3	Social feedback	IAT	IM predicts sympathy ratings for a person who had offended the participant better for participants low in working memory capacity than those high in working memory capacity
Trait self-control	Thush et al., 2008	Self-reported alcohol consumption	IAT	IM predicts self-reported alcohol consumption better for participants low in working memory capacity than those high in working memory capacity
	Grenard et al., 2008	Self-reported alcohol & cigarette consumption	WATs	IMs predict self-reported alcohol & cigarette consumption better for participants low in working memory capacity than those high in working memory capacity
	Friese & Hofmann, 2008a, Study 1	Potato chip consumption	SC-IAT	IM predicts consumption better for participants low in trait self-control than those high in trait self-control
	Friese & Hofmann, 2008a, Study 2a	Self-reported alcohol consumption (a) on an ordinary drinking occasion, and (b) during the previous week	SC-IAT	IM predicts self-reported alcohol consumption better for participants low than high in trait self-control

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Appendix (Continued)

<i>Moderator</i>	<i>Study</i>	<i>Behaviour</i>	<i>Implicit measure(s)</i>	<i>Central findings</i>
	Friese & Hofmann, 2008a, Study 2b	Self-reported alcohol consumption (a) on an ordinary drinking occasion, and (b) during the previous week	AMP	IM predicts self-reported alcohol consumption on an ordinary drinking occasion better for participants low than high in trait self-control
Trait impulsivity	Friese & Hofmann, 2008a, Study 2a	Self-reported alcohol consumption (a) on an ordinary drinking occasion, and (b) during the previous week	SC-IAT	IM predicts self-reported alcohol consumption during the previous week better for participants high than low in trait impulsivity
	Friese & Hofmann, 2008a, Study 2b	Self-reported alcohol consumption (a) on an ordinary drinking occasion, and (b) during the previous week	AMP	IM predicts self-reported alcohol consumption on an ordinary drinking occasion better for participants high than low in trait impulsivity
Ability to control nonverbal behaviour	Dasgupta & Rivera, 2006, Study 1	Positive nonverbal behaviour towards a gay man in an interaction	IAT	IM predicted less positive behaviour for participants low in behavioural control than high in behavioural control. This interaction occurred only for male participants with a low (as compared to a high) motivation to be egalitarian
	Dasgupta & Rivera, 2006, Study 2	Positive nonverbal behaviour towards a gay man in an interaction	IAT	IM predicted less positive behaviour for participants low in behavioural control than high in behavioural control. This interaction occurred only for female and male participants with a low (as compared to a high) motivation to be egalitarian

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Appendix (Continued)

<i>Moderator</i>	<i>Study</i>	<i>Behaviour</i>	<i>Implicit measure(s)</i>	<i>Central findings</i>
Cognitive capacity	Friese et al., 2008, Study 1	Choice between fruit and chocolates	IAT, P-IAT	IM predicts choice better for participants under high cognitive load than for those under low cognitive load
	Gibson, 2008, Study 2	Choice between a can of Coke and a can of Pepsi	IAT	IM predicts choice better for participants under high cognitive load than for those under low cognitive load
	Hofmann et al., 2008a, Study 1	Interracial interaction	IAT	IM is related to visual contact and speech illustrators under high cognitive load, but not low cognitive load
	Hofmann et al., 2008a, Study 2	Interracial interaction	IAT	IM is related to visual contact, speech illustrators, and body adaptors under high cognitive load, but not low cognitive load
Processing time	Scarabis et al., 2006	Choice between chocolate and fruit	2 IATs	Cognitive capacity does not moderate the predictive validity of either IM
	Friese et al., 2006	Choice between brand-name and generic products	IAT	Participants with dissociated implicit and explicit preferences predominantly chose in line with implicit preference, but only when put under time pressure
Self-regulatory resources	Friese et al., 2008, Study 2	Potato chip consumption	SC-IAT, P-SC-IAT	IM predicts consumption better for participants with depleted resources than those with full resources
	Hofmann et al., 2007	Candy consumption	SC-IAT	IM predicts consumption better for participants with depleted resources than those with full resources
	Friese et al., 2008, Study 3	Beer consumption	SC-IAT	IM predicts consumption better for participants with depleted resources than those with full resources
Mortality salience	Friese & Hofmann, 2008b, Study 2	Chocolate consumption	SC-IAT	IM predicts consumption better for participants in the mortality salience condition than those in the control condition

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<i>Moderator</i>	<i>Study</i>	<i>Behaviour</i>	<i>Implicit measure(s)</i>	<i>Central findings</i>
Alcohol	Hofmann & Friese, 2008	Candy consumption	SC-IAT	IM predicts consumption for participants who consumed alcohol, but not for sober participants
Controllability of behaviour	Dovidio et al., 1997, Study 3	Interracial interaction	SCP	IM predicts blinking and visual contact, but not participants' global evaluation of the White and Black interviewers
	Dovidio et al., 2002	Interracial interaction	SCP	IM is related to nonverbal friendliness, confederate's and observer's perceptions of friendliness, but not verbal friendliness
	Heider & Skowronski, 2007, Study 2	Same-race and interracial interactions	IAT	IM predicts Caucasian's nonverbal, but not verbal friendliness toward a Caucasian relative to an African American confederate
	Asendorpf et al., 2002, Study 1	Shy behaviour	IAT	IM relates to index of impulsive shy behaviour, but not controlled shy behaviour
	Huijding & de Jong, 2006	Fear reactions in response to spiders	EAST	IM predicts eye blink startle responses, but not approach behaviour towards a spider
	Perugini, 2005, Study 2	Choice between fruit and snack, self-reported consumption	IAT	IM predicts impulsive choice, but not self-reported consumption behaviour
Motivation to be egalitarian	Dasgupta & Rivera, 2006, Study 1	Positive nonverbal behaviour towards a gay man in an interaction	IAT	IM predicted less positive behaviour toward a gay man for male participants with a low as compared to a high motivation to be egalitarian, but only if they were low in behavioural control
	Dasgupta & Rivera, 2006, Study 2	Positive nonverbal behaviour towards a gay man in an interaction	IAT	IM predicted less positive behaviour toward a gay man for female and male participants with a low as compared to a high motivation to be egalitarian, but only if they were low in behavioural control

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Appendix (Continued)

<i>Moderator</i>	<i>Study</i>	<i>Behaviour</i>	<i>Implicit measure(s)</i>	<i>Central findings</i>
Need for cognition	Florack et al., 2001	Judgement of Turkish person	IAT	IM predicts judgement for participants low in need for cognition. Negative relationship for participants high in need for cognition
	Conner et al., 2007, Study 1	Habitualness of consuming sweets	EAST, IAT	NFC does not moderate the predictive validity of either IM
	Conner et al., 2007, Study 2	Habitualness of consuming fruit vs. sweets; choice between a piece of fruit and a chocolate bar	IAT	NFC does not moderate the predictive validity of the IM
Motivation to control prejudiced reactions	Olson & Fazio, 2004a	Trait inferences of Black and White persons	EP	IM predicts trait inferences for participants low on the restraint factor of the MCPR scale. The opposite holds for participants high on the restraint factor
Hedonic need state	Marsh et al., 2001	Condom use	EP, 2 IATs	All IMs are unrelated to condom use with steady partner. With casual partner: EP tends to correlate negatively, self-concept IAT is uncorrelated, attitudinal IAT tends to correlate positively
Social control	Gabriel et al., 2007	Helping behaviour	IAT	Public setting: The more positive the IM the more helping behaviour for participants with low motivation to control prejudiced reactions. Opposite pattern for participants high in motivation to control prejudiced reactions. Private setting: no significant predictor
Preference for intuition	Hofmann & Baumert, 2007	Probability of rejecting an unfair offer in an ultimatum game	AMP	IM predicts rejection better for participants high in preference for intuition than those low in preference for intuition

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<i>Moderator</i>	<i>Study</i>	<i>Behaviour</i>	<i>Implicit measure(s)</i>	<i>Central findings</i>
Chronic regulatory focus	Floraack et al., 2004	Choice intention between Whopper and Big Mac	IAT	Higher correlation between IM and intention for participants with chronic promotion than for those with chronic prevention focus
Affective/cognitive focus	Scarabis et al., 2006	Choice between chocolate and fruit	2 IATs	Higher correlations between IM and choice in the affective focus condition than in the cognitive focus condition
Mood	Hermesen et al., 2006, Study 1	Seating distance from posters of political parties	IAT	IM predicts seating distance for participants in positive mood, but not those in negative mood
	Hermesen et al., 2006, Study 2a	Evinced interest in becoming a blood donor	SC-IAT	IM predicts amount of information provided for participants in positive mood, but not those in negative mood
	Hermesen et al., 2006, Study 3	Choice between apple and candy bar	P-IAT	IM predicts choice for participants in positive mood, but not those in negative mood
	Hermesen et al., 2006, Study 4	Choice between apple and candy bar	P-IAT	IM predicts choice for participants in positive mood, but not those in negative mood
Situational regulatory focus	Floraack et al., 2008, Study 2	Choice between fruit and a chocolate bar	IAT	IM predicts choice better for participants in a promotion focus than in a prevention focus
	Floraack et al., 2008, Study 3	Potato chip consumption	SC-IAT	IM predicts consumption better for participants in a promotion focus than those in a prevention focus
Construct-activation affecting the validity of the measurement outcome	Perugini et al., 2007, Study 1	Self-reported consumption of alcohol and soft drinks	IAT	IM predicts consumption after self-activation condition, but not in control condition

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<i>Moderator</i>	<i>Study</i>	<i>Behaviour</i>	<i>Implicit measure(s)</i>	<i>Central findings</i>
	Perugini et al., 2007, Study 2	Studying arts vs. science	IAT	IM predicts field of study better in self-activation condition than in control condition
	Perugini et al., 2007, Study 3	Self-reported preference for eating junk food vs. healthy food	IAT	IM predicts consumption of unhealthy food in self-activation condition, but not in control condition
Construct-activation affecting the execution of behaviour	Perugini & Prestwich, 2007	Essay evaluation	IAT	IM predicts essay evaluation, but only when the stereotype of the author's nationality was activated
	Custers & Aarts, 2007	Effort to attain a goal state	EAST	IM predicts effort to attain the goal state, but only when the goal state was activated
Uncertainty	Galdi et al., 2008	Choice about a political issue (in favour, undecided, against)	SC-IAT	IM predicts later choice better for participants who are undecided than for those who are decided
	Conner et al., 2007, Study 1	Habitualness of consuming sweets	EAST, IAT	EAST predicts sweets consumption better for participants high in habitualness than those low in habitualness. No moderation effect for the IAT
Habitualness	Conner et al., 2007, Study 2	Habitualness of consuming fruit vs sweets; choice between a piece of fruit and a chocolate bar	IAT	IM predicts sweets consumption and choice better for participants high in habitualness than those low in habitualness

AMP = Affect Misattribution Procedure; EAST = Extrinsic Affective Simon Task; EP = evaluative priming; IAT = Implicit Association Test; IM = implicit measure; P-IAT = Personalised IAT; P-SC-IAT = Personalised Single Category IAT; SC-IAT = Single Category IAT; SCP = subliminal concept priming; SP = semantic priming; WAT = Word association task.