RUNNING HEAD: PREDICTIVE VALIDITY OF THE IAT

Understanding and Using the Implicit Association Test: III.

Meta-analysis of Predictive Validity

T. Andrew Poehlman & Eric Luis Uhlmann

Yale University

Anthony G. Greenwald

University of Washington

Mahzarin R. Banaji

Harvard University

CONTACT:

T. Andrew Poehlman
2 Hillhouse Avenue
Department of Psychology
Yale University
New Haven, CT 06520
Phone: (203) 436-1551
Email: t.andrew.poehlman@yale.edu

KEYWORDS: Implicit Association Test, implicit measures, implicit attitudes, automatic attitudes, implicit stereotypes, implicit self-concept, implicit social cognition, validity, prediction

Abstract

This meta-analytic review of 61 studies (86 independent samples, 6,282 subjects), found that Implicit Association Test (IAT) measures significantly predicted criterion measures, such as judgments, choices, physiological responses, and behaviors (average r = .27). Explicit (i.e., self-report) measures were also effective predictors (average r = .35). IAT measures outperformed self-report measures in the domain of stereotyping and prejudice (average rs of .25 and .13, respectively). Self-report measures outperformed IAT measures in predicting brand-related choices (rs = .71 vs. .40) and political preferences (rs = .67 vs. .41). The predictive validity of explicit measures, but not IAT measures, weakened in socially sensitive outcome domains and for responses that are difficult to consciously control. When IAT and explicit measures were strongly correlated, both predicted criterion measures more effectively than when implicit-explicit correspondence was low.

Understanding and Using the Implicit Association Test: III.
Meta-analysis of Predictive Validity

The Implicit Association Test (IAT) was introduced in 1998 as a measure of individual differences in implicit social cognition (Greenwald, McGhee, & Schwartz, 1998). Subsequently, it saw rapid adoption in research, perhaps due to its (a) producing statistically large effects, (b) being readily adapted to the measurement of associations corresponding to constructs such as attitudes, stereotypes, self-esteem, and self-concept, (c) application to fields beyond social psychology such as cognition in general, cognitive neuroscience, psychopathology, life-span development, and consumer research, and (d) potential to provide a palpable experience of the operation of attitudinal and stereotypic associations that often operate outside of awareness (Monteith, Voils, & Ashburn-Nardo, 2001).

Development of the method has been stimulated by the publications of several critiques, which have raised questions regarding the computation of the score and the mechanism that underlies the effect (Blanton & Jaccard, in press; McFarland & Crouch, 2002; Mierke & Klauer, 2003; Rothermund & Wentura, 2004). No question has been posed more often, however, than that of conceptual interpretation of IAT measures. What does the IAT measure mean? Especially, does it predict performances that validate claims that it measures implicit attitudes and other constructs of social–cognitive constructs?

Published critiques have suggested that the IAT measures of implicit attitudes actually measure environmental associations (Arkes & Tetlock, 2004; Karpinski & Hilton, 2001) or familiarity-based salience properties of categories (Rothermund & Wentura, 2004) or extrapersonal associations (Olson & Fazio, 2004a). A shared characteristic of these alternative

interpretations is that they identify the IAT with constructs that should not be correlated with individual differences in social behavior. Thus, evaluation of the IAT's ability to predict individual differences in social behavior is central to appraising the IAT's construct validity. This article provides the first comprehensive assessment of the IAT's construct validity by meta-analytically analyzing evidence accumulated since the IAT's introduction in 1998.

The Implicit Association Test (IAT) procedure

IAT measures are latency-based tasks that measure strengths of associations between target categories and attributes. Exemplars of chosen categories such as African American (AA) and European American (EA) racial categories appear on a screen and subjects are asked to rapidly classify them by pressing one of two keys (e.g., 'd' for AA, 'k' for EA). Likewise, exemplars of attribute categories (e.g., positive or negative words) are also sorted by using the same keys to correctly categorize them. In one critical block, categories and attributes are classified by pressing the same set of keys (e.g., 'd' for AA and positive vs. 'k' for EA and negative). In the other critical block, the complementary pairing is used (i.e., AA is paired with negative and EA with positive). A difference in overall speed between the two blocks is taken to indicate the direction and magnitude of association strengths among the categories and attributes (Greenwald et al., 1998). For example, faster responses when EA and positive (and AA and negative) are paired than when AA and positive (and EA and negative) are paired indicates greater association of positive valence with EA than AA and/or greater association of negative valence with EA than with AA. Such differences have been labeled *IAT effects*.

Initial evidence for the utility of the IAT

Recent research has provided evidence for the utility and psychometric properties of IAT measures as individual difference measures (Egloff & Schmukle, 2002; Greenwald & Nosek,

2001; Greenwald & Farnham, 2000; Rudman, Greenwald, Mellott, & Schwartz, 1999). Importantly, it has been shown that IAT measures are internally consistent (Bosson, Swann, & Pennebaker, 2000; Dasgupta & Greenwald, 2001; Greenwald & Nosek, 2001; Greenwald & Farnham, 2001), not confounded by subjects' familiarity with IAT stimuli (Dasgupta, McGhee, Greenwald, & Banaji, 2000; Ottaway, Hayden, & Oakes, 2001; Rudman et al., 1999), and are relatively insensitive to methodological factors such as the number of trials and target stimuli and the intertrial interval (Nosek, Greenwald, & Banaji, 2005; Greenwald et al., 1998).

A notable property IAT measures is their reliance on automatic, associative processes that are difficult to fake (Asendorpf, Banse, & Mücke, 2002; Banse, Seise, & Zerbes, 2001; Devine, Plant, Amodio, Harmon-Jones, & Vance, 2002; Egloff & Schmukle, 2002; Kim, 2003; Steffens, 2004). For instance, subjects instructed to fake positive attitudes towards gay men were able to do so on a self-report questionnaire but not on a homosexual-heterosexual IAT (Banse et al., 2001; see Kim, 2003 for similar findings with attitudes towards African-Americans). Similarly, individuals told to make a good impression in a job application scenario deliberatively altered their self-report responses to appear low in anxiety, but their scores on an anxiety IAT were relatively unaffected (Egloff & Schmukle, 2002). While individuals given experience with the task and/or told how it works show some ability to fake their scores, naïve subjects have great difficulty doing so (Kim, 2003; Steffens, 2004). At the very least, scores on IAT measures are dramatically more difficult to fake than those on explicit self-report measures (Steffens, 2004).

The present meta-analysis

In recent empirical investigations IAT measures have successfully predicted relevant outcomes ranging from anxious behaviors (Asendorpf et al., 2002) to partner race preference on

an intellectual task (Ashburn-Nardo, Knowles, & Monteith, 2003). In addition, implicitly and explicitly assessed attitudes have been shown to explain separate variance in criterion measures such as math SAT scores (Nosek, Banaji, & Greenwald, 2002a), and alcohol consumption over the course of a month (Wiers, Woerden, Smulders, & de Jong, 2002). However, in other studies IAT measures have failed to predict relevant outcomes (e.g., Karpinski & Hilton, 2001). The present research sought to combine the values of these individual investigations meta-analytically. Studies utilizing IAT measures of attitudes, stereotypes, beliefs and self-concept were considered. Of primary interest was the extent to which IAT measures were predictive of relevant criterion measures. In addition, IAT measures' predictive performance was compared to that of more traditional explicit self-report measures across a variety of domains.

This review further examined potential moderators of the relationship between criterion measures and both implicit (IAT) and explicit (self-report) measures. The primary potential moderators suggested by the literatures on implicit social cognition and the prediction of behavior were social desirability concerns, the controllability of responses on the criterion measure, and the magnitude of implicit-explicit correspondence. In addition, procedural variables, such as the order and proximity of attitude measures (both implicit and explicit) in relationship to criterion measures, were considered.

Potential Moderating Variables

Social desirability concerns

Many researchers have argued that subjects' desire to provide socially desirable responses results in inaccurate answers on self-report questionnaires (e.g., Crosby, Bromley, & Saxe, 1980; Crowne & Marlowe, 1960; Dovidio, Kawakami, Johnson, Johnson, & Howard, 1997; Fazio, Jackson, Dunton, & Williams, 1995; Nosek & Banaji, 2002). If true, the predictive

validity of explicit measures should suffer in a socially sensitive domain such as prejudice and stereotyping. In contrast, because IAT measures resist faking, they may be able to predict criterion measures equally well in socially sensitive and non-sensitive domains (Asendorpf et al., 2002; Banse et al., 2001; Egloff & Schmukle, 2002; Kim, 2003).

Social desirability pressures may lead not only to attempts at deceiving others about one's attitudes and beliefs, but also to self-deception (Paulhus, 1984). The same sorts of socially undesirable attitudes people hide from others are the same attitudes they may be motivated to hide from themselves (Greenwald, Banaji, Rudman, Farnham, Nosek, & Mellott, 2002). For instance, White Americans may fail to self-report their racial prejudices out of a fear of social censure, or because they are unwilling to acknowledge to themselves that they harbor such prejudices. Thus, a moderating role for social desirability concerns in attitude-behavior consistency may reflect either strategic deception of others (i.e., intentionally dishonest reports) or naïve self-deception (i.e., attitudes and beliefs of which the person is unaware). Because these two motives are difficult to distinguish through data relevant to the present meta-analysis, this review focuses simply on testing a moderating role for social desirability concerns.

Controllability of responses on the criterion measure

Contemporary dual-process models of social cognition propose that consciously endorsed attitudes and beliefs determine controlled actions, whereas more automatic attitudes and beliefs influence spontaneous actions (Asendorpf et al., 2002; Egloff & Schmukle, 2002; Devine, 1989; Dovidio et al., 1997; Fazio, 1990a; Wilson, Lindsey, & Schooler, 2000). Past research using implicit measures other than IAT measures has provided support for this idea, finding that while self-reported racial attitudes better predict political beliefs and assessments of criminal guilt in a mock trial, automatic racial associations better predict nonverbal behaviors towards Black

confederates (Dovidio et al., 1997; Fazio et al., 1995). Thus, when it comes to comparing the predictive validity of self-report and IAT measures, dual-process models predict stronger correlations between self-report measures and responses that are easy to consciously control, and conversely, stronger correlations between IAT measures and responses that are difficult to control.

Not all automaticity theorists have hypothesized that automatic attitudes should relate primarily to spontaneous responses (see Bargh & Chartrand, 1999; Haidt, 2001; Rudman, 2004; Wegner & Bargh, 1998). Recently, Rudman (2004) has argued that the strict dual process view that explicit measures predict controllable behaviors and implicit measures predict spontaneous acts is unnecessarily simplistic. As she notes, implicit measures sometimes correlate substantially with (highly controllable) responses on explicit measures of attitude (Nosek, 2004; Nosek & Banaji, 2002), suggesting that they may also be able to predict controllable behaviors. In addition, other theorists have suggested the possibility of automatic evaluations serving an adaptive function of providing immediate feedback on the environment, which, in turn, serves as a starting point for deliberative processing (Bargh et al., 1992; Fazio, 1990a). Thus, there are theoretical and empirical reasons to expect implicit measures to predict deliberative, controllable responses in addition to more spontaneous ones.

Implicit-explicit correspondence

A number of theorists over the past 20 years have proposed that low correspondence between automatic and controlled attitudes can result in a sense of internal conflict (Epstein, 1994; Fazio, 1990a; Gaertner & Dovidio, 1986; Nosek, 2004; Wilson et al., 2000). Considerable empirical work has documented discrepancies between automatic reactions and deliberative beliefs in the domains of problem solving (Epstein, 1994), racial prejudice (Gaertner & Dovidio,

1986; Fazio & Olson, 2003), and attitude change (Wilson et al., 2000). This theoretical and empirical work suggests that a lack of correspondence between automatic and controlled responses may reduce the ability of both IAT and explicit measures to predict criterion measures. For instance, the associations measured by IAT measures may correlate more weakly with criterion measures because of conscious attempts to override the automatic response and, at the same time, self-reported views may relate less strongly to criterion measures because automatic processes are pulling in a different direction.

In the present meta-analysis, the correlations between IAT measures and self-report measures in each study were assessed. As predicted by previous work on the correspondence between automatic and controlled attitudes, high implicit-explicit correspondence should result in better prediction by both IAT and self-report measures because these two determinants presumably work together, rather than compete, in influencing responses on criterion measures. Conversely, a low correlation between the association captured by an IAT measure and a relatively more controlled self-report measure would suggest some degree of conflict and should result in attenuated predictive power for both the IAT and explicit measures. Notably, low internal reliabilities on the part of IAT and explicit measures could result in both poor predictive validity and low implicit-explicit correspondence. This would produce an artifactual relationship between implicit-explicit correspondence and the predictive validity of IAT and self-report measures. The reliabilities of all measures were assessed to investigate this potential confound.

Order and proximity of measures

Although an ideal procedure is to administer criterion measures in a separate experimental session to avoid contamination between measures (Fazio & Olson, 2003), many

studies included in this review did not. In these single-session studies, the positioning of the IAT measure before or after the criterion measure was a variable of interest.

A number of plausible hypotheses regarding the order and proximity of the IAT and criterion measures were worth investigating. For instance, administering an IAT measure just prior to the criterion measure may temporarily increase the accessibility of the associations it measures, artificially inflating IAT-criterion measure correlations. It is also possible that completing the criterion measure just prior to the IAT measure leads to a shift in the person's associations (Bem, 1972; Festinger, 1957), likewise producing misleadingly high IAT-criterion measure correlations. The latter possibility has support from the growing evidence that implicit measures respond to situational and contextual interventions (Blair, 2002).

A third plausible hypothesis is that administering the IAT measure just prior to the criterion measure artificially *reduces* the correlations between IAT measures and criterion measures. As Monteith, Voils, and Ashburn-Nardo (2001) have shown, IAT effects are palpable to many subjects. Having an implicit test reveal one's associations may prove disconcerting, leading subjects to respond less naturally on the criterion measure.

Method

Definition of criterion measure

Any number of criterion measures can be used to examine the predictive validity of IAT measures. Significant correlations (and lack thereof) between scores on IAT measures and relevant behaviors, judgments, choices, and even physiological responses are all relevant to the predictive validity of the measure. For the purposes of the present meta-analysis, *criterion* measures are defined as any measure of a physical action, judgment, choice or physiological reaction.

To be included, criterion measures could not be conceptually identical to the predictor measures. For instance, data regarding the correlations between IAT measures and self-reported attitudes (e.g., Nosek, Banaji, & Greenwald, 2002b) were excluded on the grounds that the self-reported measures aimed to assess the same constructs (e.g., attitudes towards Math) as the IAT measures. In contrast, correlations between IAT measures and nonverbal behaviors (e.g., McConnell & Leibold, 2001) were included. Known-groups studies, which compared (for example) whether Japanese Americans and Korean Americans had more positive associations with their respective ingroup (Greenwald et al., 1998), were excluded because such group memberships are antecedents of automatic associations, not potential outcome variables.

Studies included in this review

The studies considered in this review were gathered using three methods: PsycInfo search (using the keywords "IAT", "implicit association test", "implicit measure" "implicit attitudes", "automatic attitudes" or "implicit social cognition"), internet search (using google.com, keywords: "IAT" or "implicit association test"), and email contact with the Society of Personality and Social Psychology's mailing list, requesting any in press or unpublished research using IAT measures. Authors were contacted via email for necessary analyses that were not reported in the original paper. A total of 61 separate reports (which contained 86 statistically independent samples) were included. See Table 1 for the list of included studies.

Coded characteristics of studies

Each study was coded independently by three independent raters. One rater was blind to the study results, and two were aware of the results of some, but not all, of the studies. For the two subjective study characteristics (social desirability concerns and controllability of the response on the criterion measure), the three raters' assessments formed reliable indices ($\alpha = .74$

and α = .84, respectively) and were averaged together. Results did not differ more than trivially when separate analyses were conducted for each rater's assessments. While obtaining social desirability and controllability ratings from the participants in the actual studies would of course be ideal, such data were not available. Although independent ratings have their shortcomings, they have evidenced validity in a number of meta-analytic investigations (e.g., Eagly, Johannesen-Schmidt, & van Engen, 2003). For the procedural variables (e.g., order and proximity of measures, format of criterion measure), there were virtually no disagreements between the raters, and any differences were resolved through discussion.

Social desirability concerns. Both IAT and explicit self-report measures were coded based on the extent to which reporting the attitude in question would likely raise concerns about the impression that might be made on others. For instance, reporting attitudes towards Black Americans is likely to raise social desirability concerns, but reports of attitudes towards different brands of yogurt are not. For IAT measures, ratings were based on the extent to which providing a self-report of the relevant attitude would raise social desirability concerns. To this end, separate ratings for the social desirability concerns associated with each explicit measure and IAT were generated.[1] Judgments were made on a scale of 1-7 (1 = not at all likely to be affected social desirability concerns; 7 = extremely likely to be affected by social desirability concerns). The mean social desirability rating for IAT measures was 4.43 (median = 4.0, *SD* = 2.07), with the mean for explicit measures being 4.34 (median = 4.5, *SD* = 1.95). Interrater reliability for social desirability concerns was acceptable (α = .74).

Controllability of responses on the criterion measure. Each criterion measure was coded based on the extent to which the response in question was difficult or easy to consciously control. For instance, which presidential candidate one chooses to votes for is an easy to control

act, whereas nonverbal behaviors like eye blinking or body posture are less controllable. Judgments were made on a scale of 0-10 (0 = no component of the response consciously controllable, 10 = all components of the response consciously controllable). The mean controllability rating was 6.41, with the median being slightly lower at 6.00 (*SD* = 2.62). Interrater reliability for controllability was good (α = .84).

Every IAT criterion measure correlation (ICC; *N* = 259) and explicit measure criterion measure correlation (ECC; *N* = 283) in this meta-analysis received both a social desirability rating and a controllability rating relevant only to that ICC or ECC. For example, in McConnell and Leibold (2001), the dependent variable of "speech hesitation" receiving a rating of 1 for controllability (reflecting the relative difficulty of controlling such acts), while reporting the relevant attitude (towards Black Americans) received a social desirability rating of 7 (indicating the highest level of social desirability concerns). These ratings (and the ratings for every other IAT, explicit and criterion measure in the meta-analysis) were then correlated with the ICC or ECC for that criterion variable. (For McConnell & Leibold's 'speech hesitation' variable, the ICC was *r* = .35 and the ECC was *r* = .13). Weighting the ICCs and ECCs for this analysis was not done because such a procedure would not correctly represent the correlation between the individual social desirability or controllability rating and the ICC and ECC for each criterion measure. Therefore ICCs and ECCs were not weighted, nor were they z-transformed (as ICCs and ECCs were not averaged together in this analysis).

Implicit-explicit correspondence. Implicit-explicit correspondence was operationalized as the degree to which IAT and explicit measures correlated in each independent sample (Nosek, 2004; Nosek & Banaji, 2002). High intra-sample implicit-explicit correlations reflected high implicit-explicit correspondence, whereas low IAT-explicit measure correlations reflected low

implicit-explicit correspondence. Samples with more than one explicit measure or IAT produced multiple implicit-explicit correlations, which were then converted into aggregate implicit-explicit correlations. These aggregates were computed by first transforming every available implicit-explicit correlation available using Fisher's *r*-to-z transformation, after which the transformed correlations were averaged and that average transformed back into a Pearson's *r*. This procedure produced a single summary measure of implicit-explicit correlation for each independent sample.

Order and proximity of measures. Each study was coded based on the relative position of the implicit and criterion measures (IAT first or IAT second) as well as for the relative position of the explicit measures. Studies that counterbalanced ordering were left uncoded for this variable.[2] In addition, studies were coded as to whether the explicit, IAT and criterion measures were administered in separate experimental sessions or in the same session.

Criterion measure domain. Researchers across a wide array of subdisciplines within psychology have shown interest in using IAT measures. To examine the predictive abilities of IAT measures in different domains, the studies were separated into categories based on the criterion measures represented in each study. To capture the breadth of criterion measures included in the review, ten categories were identified: achievement, brand-related choices, condom use, clinical psychology, food choices, political preferences, self-esteem, smoking behavior, stereotyping/prejudice, and 'additional studies' that did not fall into any of the other nine categories.

Each of the 10 domains was tested for within-category heterogeneity of effect sizes using the *Q*-test (Hedges & Olkin, 1985). This procedure ensures that categories can be justifiably (at least in a statistical sense) compiled into a single group. Further, differences across non-heterogeneous categories can be meaningfully compared and appraised, whereas comparisons

across heterogeneous categories are less meaningful. All categories (except food choices) were shown to be non-heterogeneous for IAT effect sizes (i.e., no intra-domain *Q*-test reached significance). Five of the domains were non-heterogeneous for explicit measures as well (stereotyping/prejudice, self-esteem, condom use, food-choices, and smoking behavior).

Format of criterion measure. Each criterion measure was coded dichotomously on how the outcome data were recorded. Responses on the criterion measures were coded as either observed (i.e., unobtrusively recorded by the experimenter) or based on a paper-and-pencil response by the subject.

Methodological properties of the IAT measure. Methodological properties of IAT measures used in each study were also coded. Because reaction-time data tend to be highly skewed, and are often log transformed to normalize the distribution (Fazio, 1990b), each study received coding on whether the IAT data were log transformed or raw millisecond latencies were used. In addition, the number of IATs completed by each subject was also coded. Finally, because pictures may be processed differently than words, studies were coded as to whether the category exemplars were represented by pictures or words.

Other study characteristics. In addition to study variables already coded for, Lipsey and Wilson (2000) recommend that studies included in a meta-analysis be coded for year of publication, type of subject (student or non-student), number of study subjects, and site of study (field or laboratory). Because the studies included in this meta-analysis relied almost exclusively on laboratory data collections using undergraduate students, neither type of subject nor site of study received coding. However, studies were coded as to their year of publication, publication status (published or unpublished), and the number of subjects in each sample.

Results

Calculation of effect sizes

Whenever possible, this review followed the method of meta-analysis recommended by Lipsey and Wilson (2000). As such, each article located for this review was separated into statistically independent samples[3] and a mean IAT-criterion measure correlation (ICC), as well as a mean explicit measure-criterion measure correlation (ECC), was computed for that sample using Fisher's *r*-to-*z* transformation. These mean correlations were then weighted using the inverse variance of the sample.[4]

From the 61 articles reviewed herein, a total of 260 IAT-criterion measure correlations (ICCs) were obtained. Within those correlations, 86 statistically independent samples were identified and aggregate ICCs for each sample were calculated using Lipsey and Wilson's (2000) weighting method. The weighted mean of these correlations was $r = .27$ (95% confidence interval ± .025), and the aggregate ICCs ranged from $r = -.21$ to $r = .79$ (individual correlations in the studies ranged from $r = -.32$ to $r = .83$). The aggregate ICCs were significantly heterogeneous ($Q = 143.7$, $p = .0001$) and their distribution was slightly negatively skewed and leptokurtic (skewness = -.059, kurtosis = .817). The non-weighted aggregate ICC mean from independent samples was very similar ($r = .28$) to the mean produced by weighted analysis.

In these same 61 articles, 283 explicit measure-criterion measure correlations (ECCs) were reported. As with ICCs, ECCs were aggregated into 61 statistically independent samples for which correlations could be computed. The weighted mean ECC for the studies therein was $r = .35$ (95% confidence interval ± .029), with aggregate ECCs ranging from $r = -.16$ to $r = .80$ (individual correlations in the studies ranged from $r = -.35$ to $r = .93$). The distribution of aggregate ECCs was significantly heterogeneous ($Q = 491.6$, $p = 10^{-68}$), positively skewed (skewness = .529) and platykurtic (kurtosis = -.468). A comparison of the mean aggregate

correlations for ICCs and ECCs revealed a significant difference such that explicit measures were found to be better overall predictors of criterion measures than IAT measures were (t = 2.40, p = .02). This difference was also significant when considering only samples for which both ICCs and ECCs were available (t = 4.94, $p < .10^{-5}$). Both IAT measures and explicit measures were significant predictors far beyond all conventional criteria for significance (both ps $< 10^{-100}$).

Social desirability concerns

As Table 2 shows, ICCs were not significantly related to social desirability concerns $r(259) = -.08$, p = .22 (i.e., the extent to which the average person is likely to be concerned about making a positive impression on others when providing their self-report). In contrast, heightened social desirability concerns significantly reduced the ability of explicit measures to predict criterion measures, $r(283) = -.36$, $p = 10^{-10.5}$ Further, after a median split on social desirability (implicit median = 4.0; explicit median 4.5), ICCs were shown to be significantly larger than ECCs when social desirability concerns were high (mean ICC = .23, mean ECC = .14; $t(61)$ = 2.70, p = .01). Conversely, when social desirability pressures were low, ECCs were significantly higher than ICCs (mean ICC = .28, mean ECC = .44; $t(82) = 2.82$, p = .01).[6]

Controllability of responses on the criterion measure

As seen in Table 2, ICCs were not significantly related to ratings of conscious controllability $r(259)$ = .11, p = .10. However, controllability ratings and ECCs were significantly correlated such that the more controllable the response in question, the better explicit measures were able to predict it, $r(283)$ = .28, $p = 10^{-6}$. After a median split for controllability (median = 6.0), ECCs were larger when controllability was high (mean ECC =

.38, mean ICC = .28; $t(85) = 4.69$, $p < .10^{-5}$). When controllability was low, the differences were non-significant (mean ICC = .24, mean ECC = .28; $t(58) = 1.34$, $p = .19$).[7]

Implicit-explicit correspondence

Implicit-explicit correspondence was assessed using the average correlation between the IAT measures and explicit measures in each independent sample (Nosek, 2004; Nosek & Banaji, 2002). High implicit-explicit correspondence (i.e., high correlations between IAT and explicit measures) was associated with both higher ICCs and ECCs. However, implicit-explicit correspondence was a significantly stronger moderator of ECCs ($r = .67$, $p = 10^{-7}$) than of ICCs ($r = .51$, $p = 10^{-4}$, $z = 2.36$, $p = .02$).

An alternative methodological explanation for these findings was of some concern. Specifically, it could be that the individual differences measures in the low implicit-explicit correspondence samples were less internally reliable, producing both low implicit-explicit correlations and poor predictive validity for both IAT and explicit measures. To examine this possibility, we coded studies for the internal consistencies of their IAT and explicit measures. IAT internal consistencies were not significantly related to either ICCs, $r = -.11$, $p = .39$, or implicit-explicit correlations, $r = -.24$, $p = .11$. Moreover, controlling for the reliability of the IAT measure, implicit-explicit correspondence was still strongly related to ICCs, partial $r = .49$, $p = .001$. Similarly, explicit measure internal consistencies were not significantly related to either ECCs, $r = -.10$, $p = .29$, or implicit-explicit correlations, $r = .05$, $p = .55$. Controlling for the reliability of the explicit measure, implicit-explicit correspondence was still strongly related to ECCs, partial $r = .63$, $p < .001$. This indicates that the effects of implicit-explicit correspondence on ICCs and ECCs are not an artifact of the reliabilities of the individual-differences measures.

An additional concern was whether the moderating effects of implicit-explicit correspondence on ICCs and ECCs were due to other moderators considered in the meta-analysis. For instance, the (apparent) effects of implicit-explicit correspondence could potentially be due to social desirability concerns attenuating both implicit-explicit correspondence and the predictive validity of IAT and explicit measures. However, as noted in Footnote 5, the effects of implicit-explicit correspondence on both ICCs and ECCs remained significant controlling for all other moderating variables.

Order and proximity of measures

Studies were coded for the order of the IAT measure and criterion measure. In addition, whether the IAT measure was administered in a separate session from the criterion measure was coded. In single-session studies the mean ICC was $r = .24$ when the IAT measure was administered just before the criterion measure and $r = .29$ when the IAT measure was just after the criterion measure, a difference that was not significant, $t(59) = 1.37$. At the same time, the mean ICC for the 13 studies in which the IAT measure was administered in a separate session (mean $r = .28$) did not differ from studies in which the IAT measure came after the criterion measure, $t(51) = .13$, or before the criterion measure, $t(32) = 1.24$ (whether the IAT measure was administered before or after the criterion measure did not affect ICCs for separate sessions studies, $t(9) = -.96$, $p = .36$). Therefore, the data provided no clear evidence that these variables affect ICCs.

For the sample of explicit measures in the present-meta analysis, ECCs were higher when explicit measures were administered just prior to the criterion measure (mean $r = .39$) than just after the criterion measure (mean $r = .31$), $t(34) = 2.39$, $p = .02$, or in a separate experimental session (mean $r = .25$), $t(22) = 3.91$, $p = .001$. The average after-criterion measure ECC was not

significantly different from the average ECC in separate-session studies, $t(30) = 1.58$, $p = .12$. These results support existing theory (Fazio, Sanbonmatsu, Powell, & Kardes, 1986) that suggests heightening the accessibility of self-reported attitudes increases attitude-behavior correspondence.

Criterion measure domain

IAT measures were significant predictors of criterion measures in all domains considered with the exception of self-esteem (see Table 3). Because there were only two studies in this domain, more research may be necessary before drawing firm conclusions about weak predictive validity of self-esteem IATs.

As noted earlier, four categories emerged where *both* IAT and explicit measures were non-heterogeneous: condom use, self-esteem, smoking behavior and stereotyping and prejudice. However, the lone category of these four to exhibit significant differences in predictive power between IAT and explicit measures was stereotyping and prejudice. In this category, both IAT measures and explicit measures were significant predictors of criterion measures, with a mean ICC of $r(32) = .25$ (95% confidence interval ± .059) and a mean ECC of $r(21) = .13$ (± .057). However, IAT measures were significantly better predictors of criterion measures than explicit measures, $t(51) = 3.17$, $p = .003$.[8] Because this domain included some samples for which there was no ECC (i.e., 32 samples contained ICCs whereas only 21 samples contained both ICCs and ECCs), this effect was also tested using criterion measures for which both ICCs and ECCs existed. In the 21 samples for which there were both ICCs and ECCs the mean ICC and ECC were the same as in the more inclusive analysis (rs = .25 and .13, respectively) and this difference was again statistically significant, $t(20) = 3.32$, $p = .003$.

As can be seen in Table 3, for the domains of brand related choices and political judgments, ECCs were significantly higher than ICCs ($t(11) = 7.34$, $p = 10^{-5}$; and $t(8) = 5.41$, $p = .001$, respectively). However, while it is likely that these results reflect true difference between ICCs and ECCs, one must always interpret statistical comparisons of heterogeneous categories (both categories of ECCs were significantly heterogeneous) with some caution.

Format of criterion measure

ICCs were not significantly influenced by whether the response on the criterion measure was observed by the experimenter or based on a report by the subject (rs = .27 and .27 respectively, $t(82) = .05$, $p = .96$). Similarly, ECCs were not significantly influenced by the format of the criterion measure being observed or self-reported, rs = .35 and .33 respectively, $t(45) = .87$, $p = .39$.

Methodological properties of the IAT measure(s)

Although previous work suggests that IAT effects get smaller as the number of IATs taken increases (Greenwald, Nosek & Banaji, 2003; Greenwald & Nosek, 2001), ICCs do not appear to be influenced by the number of IATs used in a given study (the correlation between number of IATs and ICC was $r(84) = -.12$, $p = .28$). There was also no effect of whether pictures or words were used to represent the target categories (rs = .28 and .24 respectively, $t(71) = .79$), or whether IAT scores were based on millisecond or log transformed data (rs = .29 and .32, respectively, $t(51) = .61$).

Other study characteristics

An examination of methodological and circumstantial characteristics of articles in this review was conducted. A comparison of the published ($N = 27$) and unpublished ($N = 34$) studies indicated that both mean ICCs and mean ECCs were related to publication status.

Published ICC studies (from which 49 statistically independent samples were identified) revealed a significantly lower mean ICC (r = .24) than unpublished studies (r = .30; 37 statistically independent samples), $t(84) = 3.16$, $p = .002$. Similarly, published ECC studies (39 statistically independent samples) revealed a significantly lower mean ECC (r = .32) than unpublished studies (r = .40; 22 statistically independent samples), $t(59) = 4.69$, $p = .00002$. Notably, these differences are the opposite of what would be expected were there a publication bias favoring large effect sizes. However, given the relatively recent interest in IAT measures, it is likely that a substantial portion of currently unpublished studies are 'in the pipeline' and will see publication eventually.

Although ICCs were found not to correlate significantly with publication or manuscript year, $r(283) = .059$, $p = .319$, ECCs were found to correlate significantly with publication year $r(260) = .157$, $p = .012$, such that more recent studies produced higher ECCs. The number of subjects in each sample did not correlate significantly with ICCs, $r(86) = -.129$, $p = .24$, yet number of subjects was found to correlate significantly with ECCs, $r(61) = .309$, $p = .015$.

Discussion

The present meta-analysis indicates that IAT measures are significant predictors of criterion measures (average r = .27). That IAT measures predict criterion measures across such a wide array of domains (e.g., nonverbal behaviors, impression formation, shyness, anxiety, consumer choices, and voting) indicates they have broad utility as individual-differences measures of personal attitudes and beliefs. Explicit (i.e., self-report) measures were also good predictors of criterion measures, and in fact performed significantly better overall than IAT measures did (average r = .35).

Moderators of the predictive power of IAT measures and explicit measures were also tested. The role of social desirability concerns, controllability of responses on the criterion measure, implicit-explicit correspondence, and order and proximity of measures will each be examined sequentially. Initial evidence for the incremental validity of IAT measures will then be discussed, as will the importance of placing IAT-criterion measure correlations in perspective, and situations in which IAT measures should prove most (and conversely, least) useful to researchers. Finally, an agenda for future research on the predictive validity of IAT measures is outlined.

Social desirability concerns

Whereas explicit measures were impaired in their predictive validity when social desirability concerns were high, IAT measures were relatively unaffected. This finding is consistent with previous work in which explicit measures of socially sensitive views have had difficulty predicting criterion measures (Crosby et al., 1980) and may reflect subjects' tendency to impression manage on explicit measures, along with the relative difficulty of doing so on IAT measures and other implicit measures (Nosek & Banaji, 2002). However, as mentioned in the introduction, the present meta-analysis cannot distinguish whether the moderating effects of social desirability concerns are due to dishonest reporting or self-deception (Paulhus, 1984). This remains a critical question with broad implications.

Correlations of criteria with explicit measures were markedly impaired in the stereotyping and prejudice domain, in which IAT measures were significantly better predictors of criterion measures than were explicit measures. One reason why explicit measures may have fared poorly in this domain is that participants were mostly college students, who are considerably less likely than members of the general population to endorse negative views of

minorities and women (Judd, Park, Ryan, Brauer, & Kraus, 1995). Low levels of reported prejudice among college students on explicit questionnaires reflect genuinely unprejudiced attitudes, dishonest responses on self-report measures, or a combination of the two. Studies using more other samples might find greater predictive validity for explicit measures in this domain. Regardless, the predictive validity of IAT measures in the stereotyping prejudice domain suggests that they are effective at circumventing dishonest reporting and/or self-deception in certain situations.

Notably, explicit measures outperformed IAT measures when social desirability concerns were weak (e.g., for brand related choices and political preferences). This mirrors Greenwald et al.'s (1998) finding that explicit measures revealed more reliable preferences than did IAT measures for flowers over insects, and musical instruments over weapons. One likely reason for this may be psychometric: implicit measures generally have lower internally consistencies than explicit measures (Cunningham, Preacher, & Banaji, 2001). Another is that the construct captured by explicit measures (i.e., consciously endorsed attitudes) may relate strongly to behavior so long as people both have introspective access into their attitude and report it honestly.

Controllability of responses on the criterion measure

Explicit measures were significantly better predictors of consciously controlled responses than of spontaneous, automatically occurring responses. Although self-report measures were excellent predictors of controllable acts like voting (Karpinski, 2001), they were found to be weaker predictors of spontaneous acts such as eye contact with an interaction partner and anxiety during a stressful speech (Asendorpf et al., 2002; Lemm, 2000). This dissociation is consistent with dual process models, which propose that explicitly endorsed attitudes and beliefs are most

likely to influence responses that are themselves easy to control and less likely to influence more automatic responses (Asendorpf et al., 2002; Dovidio et al., 1997; Egloff & Schmukle, 2002; Wilson et al., 2000).

Interestingly, IAT measures were similarly effective at predicting responses that are difficult to control and those that are easy to control. The significant correlations reported here between IAT measures and automatic behaviors (e.g., Asendorpf et al., 2002; Lemm, 2000) are consistent with findings wherein other implicit measures predicted such difficult-to-control actions (e.g., Dovidio et al., 1997). However, IAT measures were also significant predictors of more controllable criterion measures like brand related choices and voting (e.g., Brunel, Collins, Tietje, & Greenwald, 1999; Karpinski, 2001). This is a striking finding because many current dual-process models of social cognition (Dovidio et al., 1997; Wilson et al., 2000), predict IAT measures should relate more strongly to automatic responses than to deliberative responses like voting. However, the results of this meta-analysis suggest automatic associations may contribute similarly to both automatic and deliberative responses (Rudman, 2004). In fact, previous automaticity research has shown that even deliberative choices that are obviously guided by explicit attitudes and beliefs also possess a substantial automatic component (Bargh & Chartrand, 1999; Haidt, 2001; Rudman, 2004; Wegner & Bargh, 1998).[9]

Taken together with earlier findings that automatic associations can correlate highly with self-reported attitudes (Nosek, 2004; Nosek & Banaji, 2002; Rudman, 2004) and automatic processes contribute heavily to deliberative actions (Bargh & Chartrand, 1999; Wegner & Bargh, 1998), the present findings suggest a meaningful revision to dual process models. The conventional dual process prediction that explicitly endorsed attitudes are better predictors of controllable acts received strong empirical support from the current investigation. However, the

prediction that automatic associations primarily predict spontaneous acts did not. While further empirical work is needed, the present data make a case for revising dual process models to allow a role for automatic processes in many aspects of social cognition. One guide may be Fazio's MODE model (Fazio, 1990a), which proposes that people override the influence of their automatic associations only when they have both the motivation and opportunity to do so. Absent *either* the motivation *or* opportunity, associations automatically influence behavior. That IAT measures predicted deliberative actions suggests that people either generally lack the opportunity to correct for associative influences (perhaps because they are unconscious of their associations; Banaji, 2001) or the motivation (i.e., they are "cognitive misers" who expend mental effort only when absolutely necessary; Fiske & Taylor, 1991; Langer, 1989).

Notably, this revision to dual process models does not require that implicit measures predict behavior above and beyond self-reported attitudes and beliefs (although as will be discussed shortly, the incremental validity of the IAT is an important question in its own right). In some cases automatic associations explain unique variance in behavior (Nosek et al., 2002a), but at other times their effects on deliberative behaviors may be largely mediated by their influence on more explicit attitudes and beliefs. The role of automatic mental processes in moral judgment may serve as an illustrative example. As work by Jonathan Haidt and his colleagues demonstrates, moral judgments are largely intuitive—i.e., they simply appear in consciousness with little to no awareness of the process by which they were made (see Haidt, 2001, for a review). In such cases, the effects of automatic, associative processes are fully mediated by explicit assessments of moral blame and praise. However, automatic processes still make a critically important (if indirect) contribution to moral judgments. Similarly, when culturally conditioned automatic associations with Republicans and Democrats bias explicit attitudes

towards Republicans and Democrats, which in turn determine voting behavior, associative processes have still made an important contribution to the behavior. (Although of course longitudinal research is needed to determine whether automatic associations determine explicit attitudes or the reverse).

Implicit-explicit correspondence

Many social cognition theorists have forwarded the idea that discrepancies between automatic and controlled reactions lead to a sense of internal conflict regarding the appropriate course of action (Epstein, 1994; Gaertner & Dovidio, 1986; Nosek, 2004; Wilson et al., 2000). Consistent with this idea, low correlations between the associations tapped by IAT measures and responses on explicit measures were associated with relatively worse predictive validity for both IAT and explicit measures. When implicit-explicit correspondence is low, the associations measured by IAT measures may correlate more weakly with criterion measures because the person is attempting to intentionally override an unwanted automatic response. Additionally, self-reported views may relate less strongly to criterion measures when automatic processes are pulling the person in the opposite direction.

Implicit-explicit correspondence had a significantly stronger influence on the predictive validity of explicit measures than it did for IAT measures. Low implicit-explicit correspondence may be less detrimental to the predictive validity of IAT measures because one can be unaware of the direction and magnitude of automatic associations, and therefore unable to intentionally correct for them (Banaji, 2001; Greenwald et al., 1998). Also, in situations where such awareness is present, the motivation to override their influence may not surface (Fazio, 1990a; Wilson et al., 2000). As a result, automatic associations may continue to predict criterion measures even when explicit attitudes and beliefs lead the person in a different behavioral

direction. While this interpretation is grounded in existing theory, it is admittedly speculative. More research is needed to further examine the consequences of discrepant automatic and controlled reactions (see Jordan, Spencer, Zanna, Hoshino-Browne, & Correll, 2003; Fazio, 1990a; McGregor & Marigold, 2003).

Of additional interest is pinpointing what variables lead to discrepancies between responses on implicit and explicit measures (Nosek, 2004), and perhaps account for the effects of implicit-explicit correspondence on the predictive validity of IAT and self-report measures. The most straightforward interpretation is that implicit and explicit measures tap into distinct attitudes which sometimes correspond and sometimes do not (Banaji, 2001). However, it is also possible that social desirability concerns are the source of low correspondence between IAT and self-report measures. While the present meta-analysis found that the effects of implicit-explicit correspondence on the predictive validity of IAT and self-report measures was not reducible to social desirability concerns, it remains possible that the independent ratings of social desirability concerns imperfectly captured the intended construct. Whatever the reason for low implicit-explicit correspondence, the end result seems likely to be the same. Discrepancies between automatic and deliberative reactions reduce the extent to which *both* responses are reflected in behavior.

Order and proximity of measures

No evidence was found that order or proximity of measures is a significant moderator of the correlation between IAT measures and criterion measures. The average ICC in studies in which the IAT measure and criterion measure were administered in separate experimental sessions was similar to the average ICC in studies where the IAT measure was completed just before or after the criterion measure. This finding is of particular importance because it allays a

persistent concern regarding IAT validation studies: that administering the IAT measure and criterion measure in the same experimental session artificially inflates the predictive validity of IAT measures. At the same time, the modest number of separate-sessions studies calls for additional studies in which IAT and criterion measures are administered days or weeks apart.

Incremental validity of IAT measures

The aim of assessing the incremental validity of IAT measures— i.e., whether IAT measures are able to explain additional variance in criterion measures beyond that accounted for by explicit measures—was frustrated by a lack of multiple regression analyses that included both IAT and explicit measures simultaneously. Many studies did not report multiple regressions, and those that did often included variables other than IAT measures and explicit measures (e.g., gender or age) as well as multiple IAT and explicit measures. It is impossible to compare across standardized regression coefficients when the regression equations in question include varying configurations of predictors.

Several alternative approaches to assessing the incremental validity of IAT measures were attempted. First, all available standardized regression coefficients for IAT measures in multiple regressions that included simultaneous explicit-measure predictors were examined. As shown in Table 4, these beta statistics ranged from a low of -.03 (Egloff & Schmukle, 2002) to a high of .48 (Livingston, 2002).[10] While admittedly a weak test, it appears that IAT measures explain significant independent variance in criterion measures in at least *some* situations. (An attempt to use R^2-Change values as an indicator of the incremental validity of IAT measures was frustrated by the lack of studies reporting the relevant statistics).

Second, studies in which the correlations between IAT measures and explicit measures were extremely low (*r*s < .06, i.e., the lowest quartile) were examined. Even in this group of

studies, IAT measures were significant predictors of criterion measures (average $r(14) = .17$, $p = 10^{-7}$). This further suggests that IAT measures are able to explain some variance in criterion measures beyond explicit measures. Unfortunately, exactly how much variance remains unclear and awaits future investigation.

The predictive validity of IAT measures in perspective

The average IAT-criterion measure correlation across all of the studies included in the meta-analysis was relatively low (average $r = .27$). However, it is important to remember that the IAT is a testing procedure (like a feeling thermometer or semantic differential), not a standard measure that is administered the same way in all studies. Therefore, an average IAT-criterion measure correlation of $r = .27$ across many different criterion measures does not speak to how strongly an individual IAT measure will predict any individual criterion—a particular IAT may predict a particular outcome measure far more weakly, or strongly, than the $r = .27$ level. Moreover, a number of factors that may a role in the predictive validity of IAT measures are worth considering, and will be examined in the following paragraphs.

Scoring procedures. Correlations between IAT measures and criterion measures are likely to be at least slightly higher when the improved IAT scoring algorithm is used (see Greenwald et al., 2003, for a detailed description). The new algorithm reduces the influence of unwanted variables like task order effects, overall speed, and individual differences in the ability to inhibit competing responses (Cai, Sriram, Greenwald, & McFarland, in press; Greenwald et al., 2003; Mierke & Klauer, 2003).

Measurement error. It is possible that measurement error in IAT measures masks the true relationship between automatic associations and criterion measures (Cunningham, Nezlek, & Banaji, 2004; Cunningham, et al., 2001). The analyses reported here did not reveal conclusive

evidence for this. As reported earlier, IAT internal consistencies were not significantly associated with the predictive validity of IAT measures. Moreover, because IAT internal consistencies were generally in an acceptable range (average $\alpha = .75$), corrections for attenuation led only to moderately increased correlations between IAT and criterion measures. In the 16 studies that reported IAT internal consistencies, the average IAT-criterion measure correlation increased from $r = .23$ to $r = .26$ with correction for attenuation.

Within-study moderators. In the present meta-analysis, the average IAT-criterion measure correlation for each study was assessed. This sometimes involved averaging away interesting within-study moderators. For instance, Florack, Scarabis, and Bless (2001) found that an IAT measure predicted German students' judgments of the guilt of a Turkish criminal defendant when participants were made to feel threatened. However, automatic associations did not predict judgments of guilt in the no-threat control condition. These findings are consistent with theoretical and empirical work linking perceived threats to the expression of prejudice (Bobo, 2000; Fein & Spencer, 1997), and further suggest that (as with the link between explicit attitudes and behavior) the relationship between automatic associations and overt actions is context specific. Averaging across conditions obscures the likelihood that IAT measures will predict judgments and behaviors more effectively in some circumstances than in others.

Interaction effects. The present meta-analysis focused on the zero order correlations between IAT measures and relevant criterion measures. The associations measured by IAT measures may explain additional variance in criterion measures through interactions with self-reported attitudes and beliefs. As an illustration, recent research has reported that persons with the combination of high self-reported self-esteem and *low* self-esteem on an IAT measure are relatively high in narcissism and defensiveness (Jordan et al., 2003; McGregor & Marigold,

2003). This is consistent with theories positing that narcissism and defensiveness stem from effortful attempts to compensate for negative automatic views of the self (Coopersmith, 1959).

Finally, current evidence for the predictive validity of IAT measures can usefully be compared with the state of evidence for predictive validity of self-report measures of attitude in the first 30 or so years of research examining attitude–behavior correlations (Wicker, 1969). It took a long time indeed before self-report measures of attitudes were sufficiently refined to predict criterion measures consistently (Ajzen & Fishbein, 1977; Fazio & Zanna, 1981; Kelman, 1974). This meta-analysis is necessarily limited to results obtained in little more than six years of research using IAT measures.

When will IAT measures be most useful?

The results of the present meta-analysis support conclusions about when IAT measures should be most useful. IAT measures significantly out-predicted explicit measures in the domain of prejudice and stereotyping. This is especially encouraging given the difficulty explicit measures have historically encountered in assessing intergroup prejudice (Crosby et al., 1980). In general, the results from this meta-analysis suggest that IAT measures should be most valuable as an independent predictor of criterion measures when social desirability concerns are high and the response in question is difficult to control.

At the same time, IAT measures are also effective at predicting responses generally thought to be under conscious control, such as voting and brand related choices. In these domains, explicit measures perform better than IAT measures, but IAT measures remain a significant predictor. Implicit measures are generally acknowledged to be of value when it comes to predicting spontaneous and difficult to control acts. However, the present findings indicate that they are effective predictors of deliberative, controlled responses as well (Rudman,

2004). In terms of real world applications, then, it should be worth investigating (for example) not only whether IAT measures predict police behavior such as quick decisions to stop and search, but also the criminal sentences given by judges who have considerable opportunity for complex thought.

The present meta-analysis does not justify any sweeping claims about implicit measures outperforming or supplanting explicit measures. However, it does indicate considerable promise for using IAT measures alongside self-report measures to improve the prediction of judgments, choices, physiological responses, and behaviors.

An agenda for future research on the predictive validity of IAT measures

As this review indicates, considerable progress had been made insofar as investigating the predictive validity of IAT measures is concerned. As Table 1 shows, scores of studies have related IAT measures to relevant outcomes (judgments, behaviors, choices, and physiological reactions) and on average found significant correlations between the two. Still, there remain a number of important issues that the present meta-analysis could not address but are worth examining as part of a broader agenda for research on the predictive validity of IAT measures.

Additional research is needed examining potential moderators of the predictive validity of IAT measures in addition to those assessed here. While variables such as social desirability concerns and conscious controllability are relatively straightforward to obtain independent ratings for, other variables are more subjective and call for ratings from participants themselves and/or within-study manipulations. One such moderator is threat, which at least one investigation suggests enhances the relationship between automatic associations and intergroup judgments (Florak et al., 2001). Another is explicit motivations to control unwanted automatic reactions (Dunton & Fazio, 1997; Plant & Devine, 1998), which research using evaluative

priming measures suggests attenuates the relationship between automatic associations and behavior (Olson & Fazio, 2004b; Towles-Schwen & Fazio, 2003). Also worth examining are variables previously shown to increase correlations between explicit attitudes and behavior, such as direct experience with the attitude object (Fazio & Zanna, 1981) and attitude importance (Krosnick, 1988).

A critical need is for further exploration of the relative incremental validity of IAT and self-report measures. The studies reviewed here establish that IAT measures explain significant variance in relevant outcomes on their own; future research should rigorously test whether IAT measures predict meaningful variance above and beyond self-reported attitudes. It should become routine to combine implicit and explicit measures in multiple regression analyses. Importantly, the explicit measure should be carefully "matched" with the IAT measure. For example, the explicit measure should assess relative preferences (e.g., for European Americans vs. African Americans, as opposed to just attitudes towards African Americans). At the same time, both measures should assess the same construct (e.g., automatic attitudes and explicit attitudes, as opposed to automatic attitudes and explicit stereotypes). As memory research has shown, it is critical to equate implicit and explicit measures on as many dimensions as possible before drawing strong conclusions about the contribution of implicit forms of memory (Jacoby, 1991). The same holds true when testing whether automatic associations explain variance in behavior above and beyond self-reported attitudes and beliefs.

At the same time, examining the relationship between implicit and explicit measures on the one hand, and behaviors on the other, is not a zero-sum game. Discrepancies between automatic associations and self-reported attitudes may explain unique variance in relevant outcomes. As noted, several studies have shown that high explicit self esteem, combined with

low automatic self esteem, predicts narcissism and defensiveness (Jordan et al., 2003; McGregor & Marigold, 2003). And the present meta-analysis found that low implicit-explicit correlations were associated with reduced predictive validity for both IAT and explicit measures. While up to this point research using IAT measures has focused on their zero-order correlations with judgments and behaviors, future work should further examine the potentially multifold consequences of implicit-explicit discrepancies. Thus, multiple regressions might not only routinely include both IAT and self-report as predictors, but also their product— for the purpose of exploring mutual moderation effects such as have been demonstrated in the self-esteem domain.

Also, more studies are needed examining whether IAT measures can prospectively predict judgments and behaviors. The initial research reviewed here finds that IAT measures are just as effective at predicting relevant outcomes in separate session studies as in single session studies. But many more separate session studies are needed, especially studies in which relevant outcomes are assessed months or even years after individual differences in automatic associations are measured. The approach used in Russell Fazio's laboratory at the Ohio State University is a useful model. In this laboratory, automatic associations are routinely assessed weeks or months prior to the judgment or behavior being predicted. This approach, which has been used to validate evaluative priming measures (Fazio et al., 1995) should also be applied to the IAT.

Modifications to the IAT procedure that allow for the assessment of more varied aspects of automatic social cognition are likewise desirable. IAT measures are typically used to examine general attitudes, for instance towards "condoms," "smoking," or "Black Americans." As Ajzen and Fishbein (1977) have demonstrated, explicitly measured general attitudes are far worse

predictors of behavior than attitudes that specify the act and situation (e.g., towards "using a condom the next time I have sex"). While it remains uncertain whether IAT measures can be successfully modified for assessment of attitudinal associations for categories that require such complex descriptions, such modified measures have the potential to be especially effective predictors of behavior.

Finally, up to this point research on the predictive validity of IAT measures has been conducted in psychology laboratories with college students as subjects. While laboratory research is an important first step towards validating any individual differences measure, it ultimately becomes critical to examine the consequences of the measured variable in ecologically valid contexts and with more representative samples of participants. To give just one example, it would be interesting to assess the automatic gender stereotypes of managers and see if such associations prospectively predict their hiring decisions. Field experiments along these lines are already in their initial stages, and should go a long way toward both establishing the utility of implicit measures like the IAT and the real-world relevance of social cognition research generally.

Conclusion

This meta-analytic review finds that the Implicit Association Test predicts a wide range of criterion measures, from interracial friendliness and impression formation to anxious and shy behaviors, consumer choices, and voting. Whereas the ability of explicit measures to predict criterion measures suffered in socially sensitive domains and when responses were difficult to consciously control, IAT measures were unaffected by social desirability concerns and response controllability. IAT and explicit measures were both better predictors of criterion measures when implicit-explicit correspondence was high rather than low. The IAT was found to be a

procedure that yields reliable and valid measures that predict a wide array of meaningful outcomes.

References

* Indicates studies included in the meta-analysis.

Ajzen, I., & Fishbein, M. (1977). Attitude-behavior relations: A theoretical analysis and review of empirical research. *Psychological Bulletin, 84,* 888-918.

Arkes, H. R., & Tetlock, P. E. (2004). Attributions of implicit prejudice, or "Would Jesse Jackson 'fail' the Implicit Association Test?" *Psychological Inquiry*, *15*, 257-279.

*Asendorpf, J.B., Banse, R. & Mücke, D. (2002). Double dissociation between implicit and explicit personality self-concept: The case of shy behavior. *Journal of Personality and Social Psychology, 83,* 380-393.

*Ashburn-Nardo, L., Knowles, M.L., & Monteith, M.J. (2003). Black Americans' implicit racial associations and their implications for intergroup judgment. *Social Cognition*, *21*, 61-87.

Ayres, I. (2001). *Pervasive prejudice? Unconventional evidence of race and gender discrimination.* Chicago: University of Chicago Press.

*Baines, T., Oakes, M., & Ottaway, S. (2004). Unpublished raw data.

Banaji, M. R. (2001). Implicit attitudes can be measured. In H. L. Roedeger, III, J. S. Nairne, I. Neath, & A. Surprenant (Eds.), *The nature of remembering: Essays in honor of Robert G. Crowder*. (pp.117-150). Washington, DC: American Psychological Association.

Banaji, M.R., & Bhaskar, R. (2000). Implicit stereotypes and memory: The bounded rationality of social beliefs. In D.L. Schacter & E. Scarry (Eds.). *Memory, brain, and belief.* (pp. 139-175). Cambridge, MA: Harvard University Press.

Banaji, M.R., & Dasgupta, N. (1998). The consciousness of social beliefs: A program of research on stereotyping and prejudice. In V.Y. Yzerbyt, G. Lories & B. Dardenne (Eds). *Metacognition: Cognitive and social dimensions.* (pp. 157-170). Thousand Oaks, CA: Sage Publications.

Banse, R., Seis, J. & Zerbes, N. (2001). Implicit attitudes towards homosexuality: Reliability, validity and controllability of the IAT. *Zeitschrift fur Experimentelle Psychologie, 48,* 145-160.

*Banse, R. (2003). *Implicit attitudes towards romantic partners and ex-partners: A test of the reliability and validity of the IAT.* Unpublished manuscript.

*Banse, R., Grune, J., & Kreft, V. (2002). *Implicit attitudes towards romantic partners: Convergent and discriminant validity.* Poster presented at the 13th General meeting of the European Association of Experimental Social Psychology, San Sebastian.

*Banse, R., Seise, J. and Zerbes, N. (2001). Implicit attitudes towards homosexuality: Reliability, validity and controllability of the IAT. *Zeitschrift für Experimentelle Psychologie, 48,* 145-160.

Bargh, J.A., & Chartrand, T.L. (1999). The unbearable automaticity of being. *American Psychologist, 54,* 462-479.

Bem, D. J. (1972). Self-perception theory. In L. Berkowitz (Ed.), *Advances in Experimental Social Psychology* (Vol. 6, pp. 1-62). New York: Academic Press.

Blair, I. V. (2002). The malleability of automatic stereotypes and prejudice. *Personality and Social Psychology Review, 6*, 242-261.

Blair, I.V., Ma, J.E., & Lenton, A.P. (2001). Imagining stereotypes away: The moderation of

implicit stereotypes through mental imagery. *Journal of Personality and Social Psychology, 81,* 828-841.

Blanton, H., & Jaccard, J. (in press). Arbitrary metrics in psychology. *American Psychologist*.

Bobo, L. (2000). Race and beliefs about affirmative action: Assessing the effects of interests, group threat, ideology and racism. In D. O. Sears, J. Sidanius, and L. Bobo (Eds.) *Racialized Politics: The debate about racism in America.* (pp. 137-164). Chicago: University of Chicago.

*Bosson, J.K., Swann, W.B., Jr., & Pennebaker, J.W. (2000). Stalking the perfect measure of implicit self-esteem: The blind man and the elephant revisited? *Journal of Personality and Social Psychology, 79,* 631-643.

*Brunel, F. F., Collins, C.M., Greenwald, A.G. & Tietje, B.C. (1999). Making the public private, accessing the inaccessible: Marketing applications of the Implicit Association Test. *Polish Psychological Bulletin, 32,* 1-9.

*Brunstein, J.C. & Schmitt, C.H. (2003). *Assessing individual differences in achievement motivation with the Implicit Association Test.* Unpublished manuscript, University of Potsdam.

Cai, H., Sriram, N., Greenwald A.G., & McFarland, S.G. (in press). The Implicit Association Test's D measure can minimize a cognitive skill confound: Comment on McFarland and Crouch (2002). *Social Cognition*.

*Carpenter, S.J. (2000). *Implicit gender attitudes.* Unpublished doctoral dissertation, Yale University.

Chen, M., & Bargh, J.A. (1999). Consequences of automatic evaluation: Immediate

behavioral predispositions to approach or avoid the stimulus. *Personality and Social Psychology Bulletin, 25,* 215-224.

Chugh, D. (2004). Societal and managerial implications of implicit social cognition: Why milliseconds matter. *Social Justice Research*, *17*, 203-222.

Coopersmith, S. (1959). A method for determining types of self-esteem. *Journal of Abnormal and Social Psychology, 59,* 87-94.

Crosby, F., Bromley, S., & Saxe, L. (1980). Recent unobtrusive studies of Black and White discrimination and prejudice: A literature review. *Psychological Bulletin*, *87,* 546-563.

Crowne, D.P., & Marlowe, D. (1960). A new scale of social desirability independent of psychopathology. *Journal of Consulting Psychology, 24,* 349-354.

*Cunningham, W. A., Johnson, M. K., Raye, C. L., Gatenby, J. C., Gore, J. C., & Banaji, M. R. (in press). Neural components of conscious and unconscious evaluations of Black and White faces. *Psychological Science*.

Cunningham, W. A., Nezlek, J. B., & Banaji, M. R. (2004). Conscious and unconscious ethnocentrism: Revisiting the ideologies of prejudice. *Personality and Social Psychology Bulletin, 30,* 1332-1346.

Cunningham, W. A., Preacher, K. J., & Banaji, M. R. (2001). Implicit attitude measures: Consistency, stability, and convergent validity. *Psychological Science, 12,* 163-170.

*Czopp, A.M., Monteith, M.J., Zimmerman, R.S., & Lynam, D.R. (in press). Implicit attitudes as potential protection from risky sex: Predicting condom use with the IAT. *Basic and Applied Social Psychology.*

Dasgupta, N., McGhee, D. E., Greenwald, A.G., & Banaji, M. R. (2000). Automatic

preference for White Americans: Ruling out the familiarity explanation. *Journal of Experimental Social Psychology, 36,* 316-328.

Dasgupta, N., & Greenwald, A.G. (2001). On the malleability of automatic attitudes: Combating automatic prejudice with images of admired and disliked individuals. *Journal of Personality and Social Psychology, 81,* 800-814.

*Dasgupta, N. (2003). *The road sometimes taken: How negative affect, perceiver sex, and target sex influence the path from implicit sexual prejudice to behavior.* Unpublished manuscript, University of Massachusetts.

Devine, P.G. (1989). Stereotypes and prejudice: Their automatic and controlled components. *Journal of Personality and Social Psychology*, *56,* 5-18.

Devine, P.G., Plant, E.A., Amodio, D.M., Harmon-Jones, E., & Vance, S.L. (2002). The regulation of explicit and implicit race bias: The role of motivations to respond without prejudice. *Journal of Personality and Social Psychology, 82,* 835-848.

Dovidio, J. F., Kawakami, K., Johnson, C., Johnson, B., & Howard, A. (1997). On the nature of prejudice: Automatic and controlled processes. *Journal of Experimental Social Psychology, 33*, 510-540.

Dunton, B. C., & Fazio, R. H. (1997). An individual difference measure of motivation to control prejudiced reactions. *Personality and Social Psychology Bulletin, 23*, 316-326.

Eagly, A.H., Johannesen-Schmidt, M.C., & van Engen, M.L. (2003). Transformational, transactional, and laissez-faire leadership styles: a meta-analysis comparing women and men. *Psychological Bulletin*, 129, 569-591.

*Egloff, B. & Schmukle, S.C. (2002). Predictive validity of an Implicit Association Test for assessing anxiety. *Journal of Personality and Social Psychology,* 83, 1441-

1455.

Epstein, S. (1994). Integration of the cognitive and the psychodynamic unconscious. *American Psychologist, 49,* 709-724.

Fazio, R. H. (1990a). Multiple processes by which attitudes guide behavior: The MODE model as an integrative framework. In M. P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 23, pp. 75-109). New York: Academic Press.

Fazio, R. H. (1990b) A practical guide to the use of response latency in social psychological research. In Hendrick, C., & Clark, M.S. (Eds). Research methods in personality and social psychology. *Review of personality and social psychology* (Vol. 11, pp. 74-97). Thousand Oaks, CA, US: Sage Publications.

Fazio, R., Jackson, J., Dunton, B., & Williams, C. (1995). Variability in automatic activation as an unobtrusive measure of racial attitudes: A bona fide pipeline? *Journal of Personality and Social Psychology, 69,* 1013-1027.

Fazio, R.H., & Olson, M.A. (2003). Implicit measures in social cognition research: Their meaning and uses. *Annual Review of Psychology, 54,* 297-327.

Fazio, R.H., Sanbonmatsu, D.M, Powell, M.C., & Kardes, F.R. (1986). On the automatic activation of attitudes. *Journal of Personality and Social Psychology, 50, 229-238.*

Fazio, R.H., & Zanna, M. P. (1981). Direct experience and attitude—behavior consistency. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 14, pp. 161—202). San Diego, CA: Academic Press.

Fein, S., & Spencer, S.J. (1997). Prejudice as self-image maintenance: Affirming the self through derogating others. *Journal of Personality and Social Psychology, 73,* 31-44.

Festinger, L. (1957). *Theory of cognitive dissonance*. Stanford: Stanford University

Press.

Fiske, S. T. and Taylor, S. E. (1991) Social cognition. (2nd edn). New York: McGraw-Hill.

*Florack, A., Scarabis, M., & Bless, H. (2001). Der Einfluss wahrgenommener Bedrohung auf die Nutzung automatischer Assoziationen bei der Personenbeurteilung. /The impact of perceived threat on the use of automatic associations in person judgments. *Zeitschrift fuer Sozialpsychologie, 32,* 249-259.

*Florack, A. (2004). [raw unpublished data]

*Friedman, M., Nosek, B.A., Gordon, K., Miller, I., & Banaji, M.R. (2001). *Implicit hopelessness and depressive symptoms among married couples.* Unpublished manuscript.

Gaertner, S.L., & Dovidio, J.F. (1986). The aversive form of racism. In J.F. Dovidio, & S.L. Gaertner (Eds). *Prejudice, discrimination, and racism.* (pp. 61-89). San Diego, CA: Academic Press.

*Gawronski, B., Ehrenberg, K., Banse, R., Zukova, J., & Klaur, K.C. (2003a). It's in the mind of the beholder: Individual differences in associative strength moderate category based and individuating impression formation. *Journal of Experimental Social Psychology, 39,* 16-30.

*Gawronski, B., Geschke, D., & Banse, R. (2003b). Implicit bias in impression formation: Associations influence the construal of individuating information. *European Journal of Social Psychology, 33,* 573-589.

Gladwell, M. (2005). *Blink.* New York, NY: Little, Brown, and Company.

*Gosejohann, S., Scarabis, M. & Florack, A. (2002). *Influences of introspection on the*

consistency between automatic associations and self-reported attitudes. Poster presented at the general meeting of the European Association of Social Psychology, San Sebastian, Spain.

Greenwald, A.G., & Banaji, M.R. (1995). Implicit social cognition: Attitudes, self-esteem, and stereotypes. *Psychological Review, 102,* 4-27.

Greenwald, A.G., Banaji, M.R., Rudman, L.A., Farnham, S.D., Nosek, B.A., & Mellott, D.S. (2002). A unified theory of implicit attitudes, stereotypes, self-esteem, and self-concept. *Psychological Review, 109*, 3-25.

*Greenwald, A.G., & Farnham, S.D. (2000). Using the Implicit Association Test to measure self-esteem and self-concept. *Journal of Personality and Social Psychology, 79*, 1022-1038.

Greenwald, A.G., McGhee, D.E., & Schwartz, J.L.K. (1998). Measuring individual differences in implicit cognition: The Implicit Association Test. *Journal of Personality and Social Psychology, 74,* 1464-1480.

Greenwald, A.G., & Banaji, M.R. (1995). Implicit social cognition: Attitudes, self-esteem, and stereotypes. *Psychological Review, 102,* 4-27.

Greenwald, A.G., & Nosek, B.A. (2001). Health of the Implicit Association Test at age 3. *Zeitschrift für Experimentelle Psychologie, 48,* 85-93.

Greenwald, A. G., Nosek, B. A., & Banaji, M. R. (2003). Understanding and using the Implicit Association Test: 1. An improved scoring algorithm. *Journal of Personality and Social Psychology*, *85*, 197-216.

Haidt, J. (2001). The emotional dog and its rational tail: A social intuitionist approach to moral judgment. *Psychological Review, 108,* 814-834.

Hedges, L. V., & Olkin, I. (1985). *Statistical methods for meta-analysis*. Orlando, FL: Academic

Press.

*Hugenberg, K., & Bodenhausen, G. V. (2004). Ambiguity in social categorization: The role of prejudice and facial affect in race categorization. *Psychological Science*, *15*, 342-345.

*Hugenberg, K., & Bodenhausen, G. V. (2003). Facing prejudice: Implicit prejudice and the perception of facial threat. *Psychological Science, 14*, 640-643.

Jacoby, L. L. (1991). A process dissociation framework: Separating automatic from intentional uses of memory. *Journal of Memory and Language, 30*, 513-541.

*Jellison, W. A., McConnell, A. R., & Gabriel, S. (2004). Implicit and explicit measures of sexual orientation attitudes: Ingroup preferences and overt behaviors among gay and straight men. *Personality and Social Psychology Bulletin*, *30*, 629-642.

Jordan, C.H., Spencer, S.J., Zanna, M.P., Hoshino-Browne, E., & Correll, J. (2003). Secure and defensive high self-esteem. *Journal of Personality and Social Psychology, 85*, 969-978.

Judd, C.M., Park, B., Ryan, C.S., Brauer, M., & Kraus, S. (1995). Stereotypes and ethnocentrism: Diverging interethnic perceptions of African American and White American youth. *Journal of Personality and Social Psychology*, *69*, 460-481.

*Karpinski, A., & Hilton, J.L. (2001). Attitudes and the Implicit Association Test. Journal of Personality & Social Psychology, 81, 774-788.

*Karpinski, A. (2001). *The relationship between attitudes and the Implicit Association Test.* Unpublished doctoral dissertation, University of Michigan.

Kelman, H.C. (1974). Attitudes are alive and well and gainfully employed in the sphere of action. *American Psychologist, 29,* 310-324.

Kester, J. D. (2001). A revolution in social psychology. *The American Psychological Society Observer, 14*, 9-26.

Kim, D-Y. (2003). Voluntary controllability of the Implicit Association Test (IAT). *Social Psychology Quarterly*, *66*, 83–96.

Krosnick, J.A. (1988). The role of attitude importance in social evaluation: A study of policy preferences, presidential candidate evaluations, and voting behavior. *Journal of Personality and Social Psychology, 55,* 196-210.

Kunda, Z., Davies, P.G., Adams, B.D., & Spencer, S.J. (2002). The dynamic time course of stereotype activation: Activation, dissipation, and resurrection. *Journal of Personality and Social Psychology, 82,* 283-299.

Langer, E. (1989). *Mindfulness*. Massachusetts: Addison-Wesley.

LaPiere, R. T. (1934). Attitudes versus actions. *Social Forces, 13*, 230-237.

*Levesque, C., & Brown, K.W. (2004). *Overriding motivational automaticity: Mindfulness as a moderator of the influence of implicit motivation on day-to-day behavior.* Unpublished manuscript, Southwest Missouri State University.

Lipsey, M.W. & Wilson, D.B. (2000). *Practical meta-analysis*. Thousand Oaks, CA: SAGE Publications, Inc.

*Lemm K.M. (2000). *Personal and social motivation to respond without prejudice: Implications for implicit and explicit attitudes and behavior.* Unpublished doctoral dissertation, Yale University.

*Livingston, R. W. (2002). *When motivation isn't enough: Evidence of unintentional deliberative discrimination under conditions of response ambiguity.* Unpublished manuscript.

Lowery, B.S., Hardin, C.D., & Sinclair, S. (2001). Social influence effects on automatic racial prejudice. *Journal of Personality and Social Psychology, 81,* 842-855.

*Maison, D., Greenwald, A.G., & Bruin, R.H. (2004). Predictive validity of the Implicit Association Test in studies of brands, consumer attitudes and behavior. *Journal of Consumer Psychology, 14,* 405-415.

*Maison, D., Greenwald, A.G., & Bruin, R. (2001). The Implicit Association Test as a measure of consumer attitudes. *Polish Psychological Bulletin, 2*, 79.

*Marsh, K.L., Johnson, B.T., & Scott-Sheldon, L.A.J. (2001). Heart versus reason in condom use: Implicit vs. explicit attitudinal predictors of sexual behavior. *Zeitschrift fur Experimentelle Psychologie, 48,* 161-175.

*McConnell, A. R., & Leibold, J. M. (2001). Relations among the Implicit Association Test, discriminatory behavior, and explicit measures of racial attitudes. *Journal of Experimental Social Psychology, 37,* 435-442.

McFarland, S. G., & Crouch, Z. (2002). A cognitive skill confound on the Implicit Association Test. *Social Cognition*, *20*, 483-510.

*McGraw, K.M. & Mulligan, K. (2003). *Implicit political attitudes: Measurement and consequences for political judgment.* Unpublished manuscript, The Ohio State University.

McGregor, I., & Marigold, D.C. (2003). Defensive zeal and the uncertain self: What makes you so sure? *Journal of Personality and Social Psychology, 85,* 838-852.

Mierke, J., & Klauer, K.C. (2003). Method-specific variance in the Implicit Association Test. *Journal of Personality and Social Psychology, 85,* 1180-1192.

Monteith, M.J., Voils, C.I., & Ashburn-Nardo, L. (2001). Taking a look underground:

Detecting, interpreting, and reacting to implicit racial biases. *Social Cognition, 19,* 395-417.

*Neumann, R., Hülsenbeck, K., & Seibt, B. (2004). Attitudes towards people with AIDS and avoidance behavior: Automatic and reflective bases of behavior. *Journal of Experimental Social Psychology*, *40*, 543-550.

Nisbett, R. E., & Wilson, T. D. (1977). Telling more than we can know: Verbal reports on mental processes. *Psychological Review*, *84*, 231-259.

Nosek, B.A. (2004). *Moderators of the relationship between implicit and explicit attitudes.* Manuscript under review.

Nosek, B. A., & Banaji, M. R. (2002). [Polish language] (At least) two factors moderate the relationship between implicit and explicit attitudes. In R.K. Ohme & M. Jarymowicz (Eds.) *Natura Automatyzmow* (pp. 49-56), Warszawa: WIP PAN & SWPS.

*Nosek, B. A., Hansen, J. (2004). *The associations in our heads belong to us: Measuring the multifaceted attitude construct in implicit social cognition.* Unpublished manuscript, University of Virginia.

Nosek, B.A., Greenwald, A.G., & Banaji, M.R. (2005). Understanding and using the Implicit Association Test: II. Method variables and construct validity. *Personality and Social Psychology Bulletin, 31*, 166-180.

*Nosek, B.A., Banaji, M.R., & Greenwald, A.G. (2002a). Math = male, me = female, therefore math ≠ me. *Journal of Personality and Social Psychology, 83,* 44-59.

Nosek, B. A., Banaji, M. R., & Greenwald, A.G. (2002b). Harvesting implicit group attitudes and beliefs from a demonstration website. *Group Dynamics, 6*, 101-115.

Olson, M.A., & Fazio, R.H. (2001). Implicit attitude formation through classical

conditioning. *Psychological Science, 12,* 413-417.

Olson, M.A., & Fazio, R.H. (2003). Relations between implicit measures of prejudice: What are we measuring? *Psychological Science*, *14*, 36-39.

*Olson, M.A., & Fazio, R.H. (2004a). Reducing the influence of extra-personal associations on the Implicit Association Test: Personalizing the IAT. *Journal of Personality and Social Psychology*, *86*, 653-667.

Olson, M. A., & Fazio, R. H. (2004b). Trait inferences as a function of automatically-activated racial attitudes and motivation to control prejudiced reactions. *Basic and Applied Social Psychology, 26,* 1-11.

Ottaway, S., Hayden, D. C., & Oakes, M. (2001). Implicit attitudes and racism: Effect of word familiarity and frequency on the Implicit Association Test. *Social Cognition, 19,* 97-144.

Paulhus, D.L. (1984). Two-component models of socially desirable responding. *Journal of Personality and Social Psychology*, *46*, 598-609.

*Perugini, M. (in press). Predictive models of implicit and explicit attitudes. *British Journal of Social Psychology.*

*Phelps, E.A., O'Conner, K.J., Cunningham, W.A., Funayama, E.S., Gatenby, J.C., Gore, J.C., & Banaji, M.R. (2000). Performance on indirect measures of race evaluation predicts amygdala activation. *Journal of Cognitive Neuroscience, 12,* 1-10.

Plant, E.A., & Devine, P.G. (1998). Internal and external motivation to respond without prejudice. *Journal of Personality and Social Psychology, 75,* 811-832.

*Powell, A.J., & Williams, K.D. (2000). *The role of racial attitudes and experience in*

cross-racial identification among Asian, Caucasian and Eurasian Australians. Paper Presented at the Society for Australian Social Psychology.

*Richeson, J. A., Baird, A. A., Gordon, H. L., Heatherton, T. F, Wyland, C. L., Trawalter, S., & Shelton, J. N. (2003). An fMRI examination of the impact of interracial contact on executive function. *Nature Neuroscience, 6,* 1323-1328.

*Richeson, J.A., & Shelton, J.N. (2003). When prejudice doesn't pay: Effects of interracial contact on executive function. *Psychological Science, 14,* 287-290.

Rothermund, K., & Wentura, D. (2004). Underlying processes in the Implicit Association Test: Dissociating salience from associations. *Journal of Experimental Psychology: General, 133,* 139-165.

Rudman, L.A. (2004). Social justice in our minds, homes, and society: The nature, causes, and consequences of implicit bias. *Social Justice Research, 17,* 129-142.

Rudman, L.A., Greenwald, A.G., Mellott, D.S., & Schwartz, J.L.K. (1999). Measuring the automatic components of prejudice: Flexibility and generality of the Implicit Association Test. *Social Cognition, 17,* 437-465.

Rudman, L.A., Ashmore, R.D., Gary, M. (2001). "Unlearning" automatic biases: The malleability of implicit prejudice and stereotypes. *Journal of Personality and Social Psychology, 81,* 856-868.

*Rudman, L., Feinberg, J., & Rey, A. (2000). *Minority members' implicit stereotypes and attitudes.* Unpublished manuscript, Rutgers University.

*Rudman, L. A., & Glick, P. (2001). Prescriptive gender stereotypes and backlash toward agentic women. *Journal of Social Issues, 57*, 743-762.

*Rudman, L. A., Ashmore, R. D., & Gary, M. L. (1999). *Implicit and explicit prejudice and stereotypes: A continuum model of intergroup assessment.* Unpublished manuscript, Rutgers University.

*Rudman, L.E., & Heppen, J. (2003). Implicit romantic fantasies and women's interest in personal power: A glass slipper effect? *Personality and Social Psychology Bulletin*, *29*, 1357-1370.

*Rudman, L. A., & Lee, M. R. (2002). Implicit and explicit consequences of exposure to violent and misogynous rap music. *Group processes and intergroup relations, 5,* 133-150.

*Sargent, M.J., & Theil, A. (2001). *When do implicit racial attitudes predict behavior? On the moderating role of attributional ambiguity.* Unpublished manuscript.

*Sekaquaptewa, D., Espinoza, P., Thompson, M., Vargas, P., & von Hippel, W. (2003). Stereotypic explanatory bias: Implicit stereotyping as a predictor of discrimination. *Journal of Experimental Social Psychology, 39,* 75-82.

*Sherman, S.J., Rose, J.S., Koch, K., Presson, C.C., & Chassin, L. (2003). Implicit and explicit attitudes toward cigarette smoking: The effects of context and motivation. *Journal of Social and Clinical Psychology, 22,* 13-39.

*Spicer, C.V., & Monteith, M.J. (2001). *Implicit outgroup favoritism among African Americans and vulnerability to stereotype threat.* Unpublished manuscript.

Steffens, M.C. (2004). Is the Implicit Association Test immune to faking? *Experimental Psychology*, *51*, 165-179.

*Steffens, M.C. (2003). Faking implicit and explicit personality tests. Unpublished manuscript, Universität Trier.

*Swanson, J. E., Rudman, L. A., & Greenwald, A. G. (2001). Using the Implicit

Association Test to investigate attitude-behavior consistency for stigmatized behavior. *Cognition and Emotion, 15,* 207-230.

*Teachman, B., & Woody, S. (2003). Automatic processing in spider phobia: Implicit fear associations over the course of treatment. *Journal of Abnormal Psychology, 112,* 100-109.

Towles-Schwen, T., & Fazio, R. H. (2003). Choosing social situations: The relation between automatically-activated racial attitudes and anticipated comfort interacting with African Americans. *Personality and Social Psychology Bulletin, 29,* 170-182.

*van Baaren, R. (2003). [unpublished raw data]. University of Nijmegen.

*Vargas, P. T., von Hippel, W., & Petty, R.E. (2004). Using partially structured attitude measures to enhance the attitude-behavior relationship. *Personality and Social Psychology Bulletin, 30,* 197-211.

Wegner, D. M., & Bargh, J. A. (1998). Control and automaticity in social life. In D.T. Gilbert, S. T. Fiske, & G. Lindzey (Eds.), *Handbook of social psychology* (4th ed, Vol. 1, pp. 446-496). New York: McGraw-Hill.

Wicker, A.W. (1969). Attitudes versus actions: The relationship of verbal and overt behavioral responses to attitude objects. *Journal of Social Issues, 25,* 41-78.

*Wiers, R.W., Woerden, N.V., Smulders F. T. Y., & de Jong, P.T. (2002). Implicit and explicit alcohol-related cognitions in heavy and light drinkers. *Journal of Abnormal Psychology, 111,* 648-658.

*Williams, K., Wheeler, L., Edwardson, M., & Govan, C. (2001). *The Implicit Association Test as a measure of consumer involvement.* Unpublished manuscript.

Wilson, T., Lindsey, S., & Schooler, T.Y. (2000). A model of dual attitudes. *Psychological Review, 107,* 101-126.

*Zayas, V., & Shoda, Y. (2004). *Do automatic reactions elicited by thoughts of romantic partner, mother and self relate to adult romantic attachment?* Unpublished manuscript, University of Washington.

Zayas, V. & Shoda, Y., (1999, May). Implicit attitudes, attachment styles, and recall of mother's supportiveness: Predicting psychological abuse.* Poster presented at the annual meeting of the American Psychological Society, Denver, Co.

Author Notes

T. Andrew Poehlman, Department of Psychology, Yale University; Eric Uhlmann, Department of Psychology, Yale University; Anthony G. Greenwald, Department of Psychology, University of Washington; Mahzarin R. Banaji, Department of Psychology, Harvard University. This research was supported by National Science Foundation Grants SBR-9422242, SBR-9710172, SBR-9422241, and SBR-9709924 and by National Institute of Mental Health Grants MH-01533, MH-41328, and MH-57672. This work was also supported by a grant from the Third Millennium Foundation and a fellowship from the Rockefeller Foundation to M. Banaji. The authors would like to thank Scott Akalis, John Bargh, Max Bazerman, Victoria Brescoll, Hua Jian Cai, Dolly Chugh, Geoffrey Cohen, Alice Eagly, Jeff Ebert, Richard Eibach, Kristin Lane, Brian Nosek, Elizabeth Levy Paluck, Laurie Rudman, Konrad Schnabel, and Greg Walton for their help and advice. Please address correspondence to T. Andrew Poehlman or Eric Uhlmann at the Department of Psychology, Yale University, 2 Hillhouse Avenue, New Haven, Connecticut 06520; t.andrew.poehlman@yale.edu (203-436-1551), eric.uhlmann@yale.edu (203-436-1551).

Table 1

Studies in Meta-Analysis with IATs, Explicit Measures, Criterion Measures, ICCs, ECCs, Implicit/Explicit Correlations and IAT Position

Authors	IAT(s)[a]	Explicit Measure(s)	Criterion Measure(s)	N_{icc}	N_{ecc}	Mean ICC[b]	Mean ECC[b]	I/E[c]	Before/ After
Asendorpf et al. (2002)*	Shyness IAT	Bipolar shyness self-rating, shyness scale, sociability scale	Spontaneous and controlled shy behaviors	138	138	0.24	0.19	0.37	After
Ashburn-Nardo et al. (2003)*	Black/White attitude	Private regard for Blacks, public regard for Blacks, Black identity centrality, JLQ, Social Dominance Orientation	Black or White partner choice for an intellectual task	78	75	0.25	0.15	0.19	After
Bane et al. (2004)	Republican/Democrat attitude	Political conservatism, political affiliation	Policy views and voting	110	110	0.45	0.64	0.58	After^
Banse (2003)	Partner attitude	Cognitive, affective and behavioral partner attitudes	Psychological well being	136	136	0.31	0.45	0.41	After
Banse et al. (2002)	Partner attitude	Explicit partner attitude	Memory biases regarding partner	96	96	0.13	0.17	0.23	n/a
Banse & Fischer (2003)	Aggressive trait self concept; Aggressive interaction self-concept	FAF	Ice Hockey Penalties	50	50	0.22	-0.16	-0.06	n/a^
Bosson et al. (2000)*	Self-Esteem	RSES, SAQ, SL, SC	Feedback seeking; self-esteem expressed in essay	83	83	0.16	0.4	0.26	n/a
Brunel et al. (1999)*	IBM/Apple brand attitude, IBM/Apple brand identity	Explicit IBM/Apple brand attitude	Usage of IBM/Apple computers; Ownership of IBM/Apple	50	72	0.54	0.64	0.50	After
Brunstein & Schmitt (2003)	Successful self-concept	Achievement orientation	Concentration task	88		0.26			Before
Carpenter (2000; Sample 1)	Male/Female leader attitude	Liking and respect semantic differential for specific male/female leaders	Voting preference among males	68		0.17		0.35	After
Carpenter (2000; Sample 2)	Male/Female leader attitude	Liking and respect semantic differential for specific male/female leaders	Voting preference among females	57		0.58		0.35	After
Cunningham et al. (2003)*	Black/White attitude		Neurological responses	11		0.79			After
Czopp et al. (in press)*	Condom vs. tree attitude	Attitudes towards condoms	Condom use	132	132	0.16	0.22	0.25	n/a
Dasgupta (2003, Study 1)	Gay attitude	Attitudes towards gay males	Nonverbal behaviors towards gay males	33		0.02			After
Dasgupta (2003, Study 2)	Lesbian attitude	Attitudes towards lesbians	Nonverbal behaviors towards lesbians	53		0.24			After
Egloff & Schmukle (2002, Study 3)*	Anxiety self-concept	STAI	Anxiety during a stressful speech	62	62	0.13	0.09	-0.02	Before
Egloff & Schmukle (2002, Study 4)*	Anxiety self-concept	STAI	Nonverbal anxious behaviors	33	33	0.28	0.03	0.01	Before^
Florack (2004, Sample 1)	Fruit/chocolate self-concept, fruit/chocolate attitude	Attitudes toward fruit/chocolate	affectively focused fruit/chocolate choice	48	48	0.46	0.46	0.51	n/a
Florack (2004, Sample 2)	Fruit/chocolate self-concept, fruit/chocolate attitude	Attitudes toward fruit/chocolate	cognitively focused fruit/chocolate choice	49	49	0.09	0.31	0.51	n/a
Florack et al. (2001, Sample 1)*	German/Turk attitude IAT		Guilt judgments of Turk (threat condition)	21		0.58			

Florack et al. (2001, Sample 2)*	German/Turk attitude IAT		Guilt judgments of Turk (control condition)	27		-0.21			
Florack et al. (2001, Sample 3)*	German/Turk attitude IAT		Guilt judgments of Turk (enrichment condition)	22		0.17			
Friedman et al. (2001)	Hopelessness, depression and self-esteem IATs		Depressed Mood (BDI)	122		0.18		0.16	Before
Gawronski et al. (2003a)*	Gender stereotypes		Trait ratings of male/female interviewee	104		0.24			After
Gawronski et al. (2003b)*	Turkish/German attitude	Subtle and blatant prejudice	Judgments of a Turkish defendant	35	35	0.25	0.09	0.08	After
Gosejohann et al. (2002)	Candy bar attitude and self-concept	Explicit attitude towards candy bar brand	Candy bar choice	213	213	0.45	0.73		After
Greenwald & Farnham (2000)*	Self-Esteem IAT	Explicit self-esteem	Reactions to failure on task	87	84	0.01	0.23	0.17	Before
Hugenberg & Bodenhausen (2003, Study 1)*	Black/White attitude	Black/White feeling thermometer	Perceiving Black faces as hostile	23	39	0.45	0.15	0.36	After
Hugenberg & Bodenhausen (2003, Study 2)*	Black/White attitude	Black/White feeling thermometer	Perceiving Black faces as hostile	23	39	0.47	-0.09	-0.13	After
Hugenberg & Bodenhausen (2004, Study 1)*	Black/White attitude	Black/White feeling thermometer	Perceiving hostile faces as Black	19	39	0.41	0.21	-0.07	After
Hugenberg & Bodenhausen (2004, Study 2)*	Black/White attitude	Black/White feeling thermometer	Perceiving hostile faces as Black	56	39	0.38	0.22	0.23	Before^
Jellison et al. (2004)*	Gay/Straight attitude	Nunn-Gesser homosexual attitudes	Pro-Gay activities	39	39	0.26	0.27	n/a	After
Karpinski (2004)	Republican/Democrat attitude	Semantic Differential, Feeling thermometer and liking for Republicans and Democrats	Voting behavior	194	194	0.39	0.77	n/a	Before
Karpinski & Hilton (2001)*	Candy bar vs. apple attitude	Semantic differential, feeling thermometer and liking rating for apples and candy bars	Choice of apple vs. a candy bar	81	40	-0.05	0.40	0.04	Before
Lemm & Banaji (2000)	Gay attitude	ATG scale	Interaction with gay man	33	66	0.38	0.16	0.23	After
Levesque & Brown (2004, Study 2)	Autonomy self concept	Self determination scale	Autonomous behaviors	69	69	0.17	0.44	0.19	Before^
Levesque & Brown (2004, Study 3)	Autonomy self concept	Self determination scale	Day to day motivation	78	81	0.06	0.27	-0.02	Before^
Livingston (2001, Study 1)	Hispanic/White attitude	Feeling thermometer for Hispanics/Whites; motivation to control prejudice against Hispanics	Sentence strength for Hispanics/Whites	68	68	0.28	.00	n/a	After^
Livingston (2001, Study 2)	Hispanic/White attitude; Black/White attitude	Feeling thermometer for Hispanics/Whites/Blacks; motivation to control prejudice against Hispanics/Blacks	Sentence strength for Hispanics/Whites/Blacks	88	88	0.18	0.24	n/a	After
Maison et al. (2001, Study 1)*	Juice vs. Soda attitude	Juice and soda affect, subjective beliefs about juices and sodas, objective beliefs about juices and sodas	Juice vs. soda drinking	71	71	0.27	0.46	0.28	After
Maison et al. (2001, Study 2)*	High/low calorie foods attitude		High/low calorie food eating	50		0.34		0.38	After
Maison et al. (2004, Study 1)*	Yogurt brand attitude; Fast food brand attitude	Liking, preference and evaluation for different brands of yogurt; Liking, preference and evaluation of fast food brands	Yogurt brand eating; Fast food brand eating	38	38	0.43	0.80	0.52	After
Maison et al. (2004, Study 2)*	Coke/Pepsi attitude	Liking, preference and evaluation for Coke and Pepsi	Drinking Coke vs. Pepsi	102	102	0.45	0.80	0.42	After
Maison et al. (2004, Study 3)*	Beer brand attitude		Beer brand choice	80		0.28		0.48	After

Marsh et al. (2001)*	Condom attitude & self-concept	Feeling thermometer and semantic differential measures of condom attitudes	Condom Use	80	80	-0.01	0.27	n/a	Before
McConnell & Leibold (2001)*	Black/White Attitude	Semantic differentials and feeling thermometers for Blacks and Whites	Nonverbal behaviors towards a Black confederate	41	41	0.21	0.05	0.42	Before
McGraw & Mulligan (2003)	Republican/Democrat attitude, Conservative/liberal attitude	Political leaning questionnaire	Political judgments	93	93	0.36	0.45	0.54	After
Neumann et al. (2004)*	Attitudes about people with AIDS	Attitudes about people with AIDS	Avoiding person with AIDS	37	37	0.16	0.24	0.19	Before
Nosek et al. (2002)*	Math/Arts attitude & self-concept	Explicit math attitudes and math self-concept	Math SAT performance	227	227	0.38	0.49	0.41	Before
Nosek & Hansen (2004, Study 2)	Bush/Gore attitude; Bush/Gore personalized IAT	Bush/Gore semantic differential, direct comparison and liking; Party affiliation	Voting for Bush/Gore	82		0.47		0.56	n/a
Nosek & Hansen (2004, Study 3)	Shellfish/Peanuts attitude; Shellfish/Peanuts personalized IAT	Shellfish/Peanuts semantic differential, direct comparison and liking	Shellfish/Peanuts eating behaviors	110		0.40		0.43	n/a
Olson & Fazio (2004, Study 3)*	Apple/candy bar attitude; Apple/candy bar personalized IAT		Apple/candy bar choices	62		0.37		0.30	Before
Olson & Fazio (2004, Study 4)*	Bush/Gore attitude; Bush/Gore personalized IAT	Bush/Gore semantic differential, direct comparison and liking; Party affiliation	Voting for Bush/Gore	48	48	0.47	n/a	0.64	Before
Perugini (in press, Sample 1)*	Smoking/exercise attitude	Smoking/exercise semantic differential	Smoking	48	48	0.48	0.64	0.48	n/a
Perugini (in press, Sample 2)*	Snacks/fruits attitude	Snacks/fruits semantic differential	Candy bar/fruit choices	109	109	0.19	0.28	0.09	Before
Phelps et al. (2000)*	Black/White attitude	MRS	Amygdala Activation	12	12	0.55	0.05		After
Powell & Williams (2000)	Asian/White Australian attitude		Ability to recognize Asian/White faces	55		0.31			n/a
Richeson et al. (2003)*	Race IAT		Neurological responses; Self-regulatory behavior	8		0.49			Before^
Richeson & Shelton (2003)*	Black/White attitude	Affective Prejudice Scale	Regulatory depletion; Inhibited behavior	21	21	0.21	0.26	0.24	Before
Rudman et al. (2000, Study 1)	Negative Jewish stereotypes, positive Jewish stereotypes	Negative Jewish stereotype index, positive Jewish stereotype index, feeling thermometers for Jews/Christians, MAAS	Funding of Jewish student organizations	44	44	0.40	0.35	0.35	After
Rudman et al. (2000, Study 2)	Negative Japanese stereotypes, positive Japanese stereotypes, Japanese Attitude	Negative Japanese stereotype index, positive Japanese stereotype index, feeling thermometers for Japanese and White Americans, MAAS	Funding of Japanese student organizations	89	89	0.26	0.11	0.10	After
Rudman et al. (2000, Study 3)	Negative Black stereotypes, positive Black stereotypes, Black/White Attitude	Negative Black stereotype index, positive Black stereotype index, feeling thermometers for Blacks and Whites, MRS	Funding of Black student organizations	116	116	0.13	0.04	0.19	After
Rudman et al. (1999, Study 1)*	Negative Black stereotypes, positive Black stereotypes, Black/White Attitude	Negative Black stereotype index, positive Black stereotype index, feeling thermometers for Blacks and Whites, MRS	Verbal, defensive and offensive discrimination against Blacks	64	64	0.24	0.38	0.19	Before
Rudman et al. (1999, Study 2)*	Negative Black stereotypes, positive Black stereotypes, Black/White Attitude	Negative Black stereotype index, positive Black stereotype index, feeling thermometers for Blacks and Whites, MRS	Verbal, defensive and offensive discrimination against Blacks	35	35	0.24	0.39	0.23	Before
Rudman & Glick (2001)*	Male/Female stereotypes	Male/Female stereotype familiarity, ASI	Backlash against female applicant	172	172	0.29	0.01	-0.01	n/a^
Rudman & Heppen (2003, Study 1)*	Romantic fantasy IAT	Romantic fantasy index	Women's career aspirations	77	75	0.32	0.06	0.17	After
Rudman & Heppen (2003, Study 2, Sample 1)*	Romantic fantasy IAT	Romantic fantasy index	Women's career aspirations	121	121	0.17	-0.03	-0.09	After

Rudman & Heppen (2003, Study 2, Sample 2)*	Romantic fantasy IAT	Romantic fantasy index	Men's career aspirations	86	86	-0.02	-0.01	-0.09	After
Rudman & Heppen (2003, Study 3, Sample 1)*	Romantic fantasy IAT	Romantic fantasy index	Women's career aspirations	73	73	0.33	-0.07	-0.33	n/a
Rudman & Heppen (2003, Study 3, Sample 2)*	Romantic fantasy IAT	Romantic fantasy index	Men's career aspirations	54	54	-0.14	0.08	-0.33	n/a
Rudman & Lee (2002)*	Negative Black stereotypes	Negative Black stereotype index, MRS	Trait judgments of a Black man	38	38	0.24	0.15	0.30	Before^
Sargent & Theil (2001)	Black/White attitude		Sitting with a Black/White person in an attributionally ambiguous situation	19		0.54			After
Sekaquaptewa et al. (2003)*	Black/White attitude	MRS	Friendliness towards Black person	79	79	0.03	0.01	0.16	After
Sherman (2003)*	Smoking vs. miscellaneous attitude	Global smoking attitudes	Smoking	54		0.12			
Spicer & Monteith (2001)	Black/White attitude		Stereotype threat indicators	78		0.20			n/a
Steffens (2003, Study 1)	Agreeable self-concept, emotionally labile self-concept, culturally interested self-concept, introverted/extroverted self-concept	NEOFFI	Agreeable, neurotic, open and extroverted behaviors	89	89	0.20	0.09	-0.10	n/a
Steffens (2003, Study 2)	Conscientious self-concept	NEOFFI	Conscientious behaviors	48	48	0.15	0.07	0.22	Before^
Swanson et al. (2001, Study 2)*	Meat/other protein attitude & self-concept; smoking/stealing attitude, smoking identity	Feeling thermometer and semantic differential for meat/other protein sources as well as for smoking and stealing	White meat and other protein eaten in the last year; Cigarettes smoked per day	98	98	0.24	0.45	0.23	After
Swanson et al. (2001, Study 3)*	Smoking attitude, smoking identity	Feeling thermometer and semantic differential for smoking and non-smoking	Cigarettes smoked per day	70	70	0.36	0.49	0.22	After
Teachman & Woody (2003)*	Fear of spiders vs. snakes, Disgust towards spiders vs. snakes, danger associated with spiders vs. snakes, spiders/snakes attitude	Fear of spiders questionnaire, spider phobia questionnaire	Spider approach, anxiety in the presence of spiders, disgust for spiders	59	59	0.24	0.65	0.25	n/a
Van Baaren (2003)	Dutch/Moroccan attitude		Interpersonal mimicry of Dutch/Moroccan partner	n/a		0.30			n/a
Vargas et al. (2004)*	Religious self-concept	RAS, religion/non-religion semantic differential, religiosity question	Religious behaviors	226	226	0.17	0.58	0.20	After
Wiers et al. (2002)*	Alcohol attitude, alcohol arousal	Global attitudes towards alcohol, VAS arousal, VAS sedation, positive/negative reinforcement expectancies about alcohol, negative expectations about alcohol	Alcohol (ab)use	48	48	0.34	0.29	0.06	Before^
Williams et al. (2001)	Magazine brand self-concept		Consumer involvement with magazine brands	74		0.34			n/a
Zayas & Shoda (1999)	Mother attitude (support/rejecting)	Parental Bonding Instrument	Psychological abuse of spouse	85	85	0.22	0.09	0.26	After
Zayas & Shoda (2004, Study 1)	Partner attitude		Relationship break up	58		0.28			After
Zayas & Shoda (2004, Study 2)	Partner attitude		Relationship satisfaction	85		0.32			n/a^

[a] Attitude IATs use the categories “good” and “bad”, while self-concept IATs use the categories “me” and “not me” or “self” and “other”.

[b] ICC = IAT-Criterion measure Correlation; ECC = Explicit measure-Criterion measure Correlation. ICCs and ECCs are the per sample average correlation between the criterion measures and the implicit/explicit measures. These averages were computed by *z*-transforming the raw

correlations, averaging the *z*-transformed correlations, then performing the inverse of Fisher's *r*-to-*z* transformation.

[c] I/E = Implicit/Explicit per sample correlation. This correlation was computed by *z*-transforming the raw implicit/explicit correlations for each pair of measures, averaging the *z*-transformed correlations together, then performing the inverse of Fisher's *r*-to-*z* transformation.

***** The study is either published or in press.

^ IAT was administered in a separate session from the criterion measure.

Table 2. *Moderators of IAT-Criterion measure and Explicit measure-Criterion measure Correlations (ICCs/ECCs)*

	ICC (N=259)	ECC (N=283)
Social desirability rating	-.08	-.36**
Controllability rating	.11	.28*

Correlations between social desirability and controllability ratings and each reported IAT-Criterion measure Correlation (ICC) and Explicit measure-Criterion measure Correlation (ECC). Ns represent number of ICCs/ECCs used in this calculation.

* $p < 10^{-6}$

** $p < 10^{-10}$

ICCs = IAT-Criterion measure Correlations

ECCs = Explicit measure-Criterion measure Correlations

Note: For this analysis both ICCs and ECCs were neither weighted, nor *z*-transformed. Weighting the ICCs/ECCs for this analysis would distort the correlation between the individual social desirability/controllability rating and the ICC/ECC for each criterion measure.

Table 3. *Mean IAT-Criterion measure and Explicit measure-Criterion measure correlations (ICCs/ECCs) by domain (cell Ns in parentheses)*†

	Mean ICC	Mean ECC
All Studies*	.27 (N=86)	.35 (N=61)
Achievement	.35 (N=2)	.49 (N=1)
Brand Related Choices*	.40 (N=8)	.71 (N=5)
Clinical Psychology	.24 (N=9)	.25 (N=8)
Condom Use^	.14 (N=2)	.24 (N=2)
Food Choices	.25 (N=6)	.34 (N=4)
Political Preferences*	.41 (N=7)	.67 (N=3)
Self-Esteem^	.08 (N=2)	.31 (N=2)
Smoking Behavior^	.34 (N=3)	.62 (N=2)
Stereotyping/Prejudice*^	.25 (N=32)	.13 (N=21)
Additional Studies	.18 (N=15)	.25 (N=13)

†All cells are significantly different from 0 except the mean ICC in the Self-Esteem domain.
* Indicates a significant difference between the two correlations
^ Indicates both categories are non-heterogeneous
ICC = IAT-Criterion measure Correlation
ECC = Explicit measure-Criterion measure Correlation

Table 4

Complete list of standardized regression coefficients (Betas) harvested from papers in the meta-analysis with IATs, Criterion Measures, Beta values, Ns and p-values

Authors	IAT	Criterion Measure	Beta[a]	N[b]	*p*[c]
Carpenter (2000)	Male/Female leader attitude	Voting preference among females	0.30	57	0.02
Egloff & Schmukle (2002, Study 3)	Anxiety self-concept	Self rated anxiety at t=2	-0.03	62	nr
		Self rated change in anxiety from t=1 to t=2	0.06	62	nr
		Experimenter rated anxiety at t=2	0.18	62	nr
		Experimenter rated change in anxiety from t=1 to t=2	0.29	62	0.05
		Performance on concentration task at t=2	0.12	62	nr
		Change in performance on concentration task from t=1 to t=2	0.29	62	0.05
Egloff & Schmukle (2002, Study 4)	Anxiety self-concept	Nervous mouth movements	0.32	33	0.10
		Eye blinks	0.00	33	nr
		Hand position/movements	0.38	33	0.05
		Speech dysfluency	0.27	33	0.10
		Global anxiety rating	0.37	33	0.05
Friedman et al. (2001)	Hopelessness IAT	Depressed mood	0.16	122	0.01
Hugenberg & Bodenhausen (2003, Study 1)	Black/White attitude	Perceiving hostile faces as Black	0.46	24	0.02
Hugenberg & Bodenhausen (2003, Study 2)	Black/White attitude	Perceiving hostile faces as Black	0.42	24	0.04
Hugenberg & Bodenhausen (2004, Study 1)	Black/White attitude	Perceiving Black faces as hostile	0.46	19	0.05
Hugenberg & Bodenhausen (2004, Study 2)	Black/White attitude	Perceiving Black faces as hostile	0.38	57	0.01
		Rating Black faces as hostile	0.32	57	0.02
Jellison et al. (2004)	Gay/Straight attitude IAT	Positive reinforcement expectancies (among gay males)	0.44	39	0.01
		Gay-oriented activity involvement (among gay males)	0.38	39	0.05
		Trying to pass as straight (among gay males)	0.09	39	nr
		Disclosing sexual orientation (among gay males)	0.17	39	nr
Karpinski (2001)	Bush/Gore attitude	Voting	0.00	194	0.90
Karpinski & Hilton (2001)	Candy Bar/Apple attitude	Candy Bar/Apple choice	0.00	81	0.90
Livingston (2001, Study 2)	Hispanic/White attitude	Sentence strength for Hispanics	0.06	88	0.24
	Black/White attitude	Sentence strength for Blacks	0.48	88	0.08
Nosek et al. (2002)	Math/Arts attitude	Math SAT performance	0.21	227	0.001
	Math/Arts stereotype	Math SAT performance	0.14	227	nr
Richeson & Shelton (2003)	Black/White attitude	Regulatory depletion	0.39	21	0.04
		Inhibited behavior	0.25	20	0.05
Sekaquaptewa et al. (2003)	Black/White attitude	Friendliness towards Black person	0.05	79	0.65
Vargas et al. (2004)	Religious self-concept	Religious behaviors	0.00	226	0.98

Note: The IAT-Criterion measure Betas in this table come from regression equations which varied substantially in terms of both number and type of predictors. Therefore the Betas in this table are not meant to be compared to each other and are given here for solely descriptive purposes.

nr = Not reported

[a] Standardized regression coefficient for IAT and criterion measure.

[b] N that Beta is based on.

[c] p-value associated with Beta.

Footnotes

[1] While generating ratings of social desirability was done separately for IAT and explicit measures out of necessity (i.e., self-report scales sometimes attempted to tap slightly different attitudes than those assessed by the IAT measure to predict the same criterion measure), it is important to note that ratings of social desirability for IAT measures and explicit measures correlated $r(223) = .97$, $p = 10^{-9}$.

[2] Unfortunately, the studies that counterbalanced the order of IAT and criterion measures did not report effects separately for each counterbalancing order. As a result, we were unable to include these studies in the relevant analyses.

[3] Lipsey and Wilson (2000) define statistical independence as a situation in which "no more than one effect size comes from any subject sample." ^**ADD PAGE NUMBER**

[4] In correlational meta-analysis, the effect size r, is transformed into a z-score by using Fisher's r-to-z transformation: $z_r = .5\log_e [(1+r)/(1-r)]$. These z-scores are then weighted using the inverse variance estimate of the resulting z_r. The standard error (variance estimate) of z_r is equal to $1/\sqrt{(n-3)}$. Therefore, the inverse of this variance estimate (and weight for z_r) is (n-3). For a more detailed description see Hedges and Olkin (1985, p. 333).

[5] None of the significant moderators reported here became nonsignificant in linear regressions predicting ICCs and ECCs from all of the potential moderating variables. However, data were either missing or not available for some moderators, leading to a loss of over 50% of our samples when all moderators were entered into a regression together. Therefore, we report tests for the significance of each moderator separately.

[6] When using raw, non-weighted correlations this pattern holds, such that ICCs were significantly larger than ECCs when social desirability concerns were high (mean ICC = .28, mean ECC = .22; $t(147) = 2.24$, $p = .03$) and ECCs were larger than ICCs when social desirability pressures were low (mean ECC = .34, mean ICC = .26; $t(181) = 2.45$, $p = .01$).

[7] When using non-weighted correlations, this pattern changes somewhat. ECCs were only marginally higher than ICCs when controllability was high (mean ECC = .34, mean ICC = .28; $t(257) = 1.73$, $p = .09$), however when controllability was low, the reverse was true (mean ICC = .26, mean ECC = .20; $t(218) = 1.97$, $p = .05$).

[8] Stereotyping and prejudice related acts were rated as about as controllable ($M = 6.3$) as those in the other domains (average $M = 6.2$); thus, differences in controllability do not seem to account for the superior performance of IAT measures in this domain. ***In contrast, the stereotyping and prejudice domain was rated as significantly more likely to evoke social desirability concerns (*Ms* = ^NUMBER and ^NUMBER, respectively), suggesting that heightened social desirability concerns help explain the poor performance of explicit measures in this domain.**

[9] At first glance, the present results seem to contradict studies showing 'double dissociations', in which IAT measures predicted automatic behaviors and explicit measures predicted controllable behaviors (e.g., Asendorpf et al., 2002). However, it is important to distinguish the effects of the shared vs. unshared variance between IAT and explicit measures. For instance, Asendorpf et al. (2002) found that, controlling for the shared variance between the implicit and explicit measures, IAT measures better predicted spontaneous indicators of shyness and self-reported shyness better predicted controllable indicators of shyness. In contrast, the present-meta-analysis considered only the main effects of IAT and explicit measures, without removing the shared variance between them. It is possible that the variance in IAT measures that is *not* shared with explicit measures betters predicts automatic than controllable behaviors; we leave the resolution of this issue to future research.

[10] Table 4 represents all beta statistics (i.e., standardized regression coefficients) reported in the articles in the meta-analysis. Due to the substantial differing (both in content and number) of variables in the regressions reported, we caution that this is only a descriptive analysis to show that, in fact, IAT measures have predicted variance above and beyond other measures. However, because the statistics reported in Table 4 are based on wholly different regression equations we do not purport to claim these variables are standardized and therefore cannot be compared in an 'apples to apples' way.