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Understanding and Using the Implicit Association Test: V. Measuring Semantic Aspects of Trait Self-Concepts

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Abstract

Implicit Association Tests (IATs) often reveal strong associations of self with positive rather than negative attributes. This poses a problem in using the IAT to measure associations involving traits with either positive or negative evaluative content. In two studies, we employed non-bipolar but evaluatively balanced Big Five traits as attribute contrasts and explored correlations of IATs with positive (e.g. sociable vs. conscientious) or negative (e.g. reserved vs. chaotic) attributes. Results showed (a) satisfactory internal consistencies for all IATs, (b) explicit–explicit and implicit–implicit correlations that were moderate to high and comparable in strength after both were corrected for attenuation and (c) better model fit for latent variable models that linked the implicit and explicit measures to distinct latent factors rather to the same factor. Together, the results suggest that IATs can validly assess the semantic aspect of trait self-concepts and that implicit and explicit self-representations are, although correlated, also distinct constructs. Copyright © 2008 John Wiley & Sons, Ltd.

Key words: implicit personality self-concept; semantic associations; valence associations; Big Five

Often we realize very quickly whether we like or dislike something or somebody without conscious insight into reasons for our preferences (e.g. Fazio, Sanbonmatsu, Powell, & Kardes, 1986; Zajonc, 1980). Implicit measures, for instance, the Implicit Association Test (IAT, Greenwald, McGhee, & Schwartz, 1998), provide access to the measurement of these automatic preferences. These implicit measures typically assess the speed with which target objects are combined with positive versus negative attributes. In the IAT, stimuli of a two target concepts (e.g. 'Black' vs. 'White' in a race attitude IAT) and two attribute concepts (e.g. 'pleasant' vs. 'unpleasant') have to be categorised by the use of two response keys. In two different phases of the test, the two possible target–attribute pairings are

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mapped on the right versus left response key. For instance in the race IAT, either the category pairs 'Black'+'pleasant' and 'White'+'unpleasant' are assigned to the right versus left keys, respectively, or the categories 'White'+'pleasant' and 'Black'+ 'unpleasant' are so assigned. When associated categories share the same response key responding should be faster. IAT scores are based on the difference in mean response latencies between the two combined tasks. In the example above, the IAT score reflects the relative strengths of associations of Black versus White race with positive versus negative valence. This IAT can be described as providing an implicit measure of relative preference for Blacks relative to Whites.

THE IAT AS A MEASURE OF SELF–TRAIT ASSOCIATIONS

In their first publication on the IAT, Greenwald et al. (1998) suggested its possible use to assess strengths of associations with attributes other than valence. For instance, the IAT has been used to measure gender stereotypes by assessing associations between male and female and various domains such as job positions, fields of study, or attributes like 'strong' versus 'warm' (cf. Rudman, Greenwald, & McGhee, 2001). Also, the IAT can be used to assess the implicit self-concept by assessing associations between the self and trait attributes. When the IAT was used to assess associations between the self and personality traits, it was shown to predict spontaneous behaviour related to these traits better than did explicit questionnaire measures (e.g. Asendorpf, Banse, & Mücke, 2002).

However, using the IAT to assess semantic, non-evaluative stereotypes or self-concepts also raised questions about the validity of these IAT variants, because most of the attribute categories in these IATs are confounded with positive or negative valence. For self-concept IATs, this is true because many personality describing attributes (e.g. shy, anxious, courageous, sociable) are infused with positive or negative valence. Several studies that aimed to assess associations between the self and specific semantic concepts actually used self-associations that were confounded with valence (Asendorpf et al., 2002; Egloff & Schmukle, 2002; Schnabel, Banse, & Asendorpf, 2006a,b). As a consequence, two main problems may evolve. First, participants may recode the IAT categorisation task from, e.g. 'anxious' versus 'courageous' into 'negative' versus 'positive' in order to facilitate the task (Schnabel et al., 2006a). Second, participants typically have a strong tendency to associate their own self with positive rather than with negative attributes (Greenwald & Farnham, 2000). Consequently, implicit self-esteem may contaminate the results of these IATs by promoting self-favourable responses. One may try to avoid implicit self-esteem contamination by disentangling valence from semantic content and by searching neutral or evaluatively opposite synonyms to genuinely positive or negative traits (cf. Steffens & Schulze-König, 2006). However, evaluatively different or neutral synonyms may be hard to find for traits (e.g. anxiousness) that are intrinsically related to valence.

Rudman et al. (2001) showed that female participants had weaker effects in gender-stereotype IATs, if gender attributes were valence-confounded rather than valence-matched. The valence-confounded gender IAT assessed associations between 'male' versus 'female' as the target and 'strong' versus 'weak' as attribute concepts. In contrast, the valence-matched gender IAT employed 'strong' versus 'delicate' as attribute categories. Rudman et al. (2001) explained the weaker effect in the valence-confounded IAT by assuming that women may associate their own gender with positive attributes even when these positive attributes are stereotypically male. The key influence of stimulus valence on

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IAT effects was also revealed by another line of research showing that features of the category labels as well as features of the individual stimuli influence IAT effects (Steffens & Plewe, 2001). In several studies, the IAT effect was considerably decreased or even reversed when the valence of the category exemplars was inconsistent with the valence of the category labels (Blümke & Friese, 2006; Govan & Williams, 2004).

Amodio and Devine (2006) successfully separated effects of positive and negative valence from effects of specific semantic meaning in race IATs. They employed one IAT that assessed associations between Blacks and Whites and positive versus negative attributes, and one IAT that assessed associations between Blacks and Whites and mental versus physical strength. The results showed unique effects of the IAT measuring implicit race preferences and the IAT measuring implicit race stereotyping. Implicit stereotyping, but not evaluation, predicted stereotype-consistent expectations of how well the African American partner would perform on a short writing task. On the other hand, implicit evaluative race bias, but not stereotyping, predicted sitting distance from the African American partner's belongings and intentions to become friends with the African American partner.

In a similar vein, Perkins and Forehand (2006) completed a series of experiments in which they employed IATs to assess associations between the self and self-descriptive attributes. In these experiments, participants had to generate attributes that described themselves. The self-generated attributes were then used in idiographic IATs. Results showed much stronger self-associations with self-generated, self-descriptive attributes (e.g. ambitious) than with attributes that shared valence but not semantic meaning (e.g. easygoing) with these self-descriptive attributes. Another IAT also revealed stronger self-associations with opposite-valence synonyms of the self-generated attributes (e.g. cutthroat) than with attributes that shared valence but not semantic meaning (e.g. easygoing). However, the IAT effects in this latter IAT, based on synonymous but oppositely valenced self-descriptive attributes, were considerably smaller than in the IAT using the original self-generated attributes.

Together, the results of these previous studies provide evidence that IATs are influenced not only by the positive and negative valence of the attribute categories but also by their specific semantic meaning. Nevertheless, Perkins and Forehand's (2006) studies also showed that the valence of the attribute stimuli contributes to the size of IAT effects in self-concept IATs. Similarly, valence asymmetries had unexpected effects on the IAT mean scores of gender stereotype IATs in the studies by Rudman et al. (2001). Thus, IAT effects seem to be influenced by both the semantic meaning and the valence of the respective stimuli. Consequently, IAT effects may be contaminated, and the validity of IATs may be threatened if valence and semantic meaning are confounded in the IAT categories

AIMS OF THE PRESENT RESEARCH

The present studies aimed to test the validity of self-concept IATs for the assessment of non-evaluative, semantic associations. To avoid valence as a confounding variable we balanced the valence of the trait categories such that the stimuli of both IAT attribute categories had the same valence. For standard personality traits, it is difficult to evaluatively balance the two poles of typical personality dimensions such as 'agreeable' versus 'disagreeable' or 'anxious' versus 'relaxed' because the semantic meaning is inextricably confounded with valence. Similarly, it is difficult to find evaluatively neutral synonyms for these trait

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categories. Therefore, we employed a method that contrasted two different but evaluatively balanced Big Five traits as attribute categories. In two studies, we used IATs that were designed to assess the contrast between two different traits (conscientiousness vs. extraversion in Study 1; conscientiousness vs. agreeableness in Study 2). Traits were represented either with evaluatively positive attributes (e.g. 'orderly' vs. 'gregarious' in Study 1; e.g. 'orderly' vs. 'bighearted' in Study 2) or with evaluatively negative attributes (e.g. 'chaotic' vs. 'shy' in Study 1; e.g. 'chaotic' vs. 'egoistic' in Study 2). Within both studies the positive attribute IAT was designed to assess the identical semantic contrast as the negative attribute IAT. Therefore, we expected the IATs to be significantly correlated, revealing their convergent validity for the assessment of specific semantic self-associations. The current studies extended the approach of Perkins and Forehand (2006) by exploring the influence of specific semantic meaning not only on the magnitude of IAT effects but also on the magnitude of correlations between semantically parallel IATs.

METHODS

Overview of procedure and design

Data were collected in two studies with similar procedures. Therefore, procedures and results of both studies are reported together. Both studies included two self-concept IATs and explicit self-ratings on the IATs' attribute stimuli. Study 1 used conscientiousness and gregariousness as trait categories. We used gregariousness (a facet trait of extraversion) rather than extraversion, because we did not want to use the relatively uncommon term 'extraverted' as category label for an IAT in an internet sample. Conscientiousness and gregariousness were represented either with evaluatively positive attributes (e.g. 'orderly' vs. 'gregarious') or with evaluatively negative attributes (e.g. 'chaotic' vs. 'shy'). Study 2 used conscientiousness and agreeableness as traits. These trait categories were represented either with evaluatively positive attributes (e.g. 'orderly' vs. 'bighearted') or with evaluatively negative attributes (e.g. 'chaotic' vs. 'egoistic'). Data were collected online on www.psytests.de, the internet portal for online studies of the Psychology Department, Humboldt University, Berlin. Participants were informed that the studies were about personality traits and that they included a questionnaire and a sorting task. The studies were described as lasting about 15 minutes, and participants were promised and received feedback on their results after completion of the tasks. Order of IATs, order of combined tasks within IATs and order of IATs and self-ratings were counterbalanced across participants. The design of each study was a 2 (IAT: positive vs. negative attributes) $\times$ 2 (IAT order) $\times$ 2 (IAT block order: 'me'+'conscientious' pairing first vs. second) $\times$ 2 (implicit-explicit order: IATs vs. self-ratings first) $\times$ 2 (participant sex) mixed factorial, with repeated measures on the first factor.

Participants

A total of 201 (164 females) and 192 (130 females) volunteers participated in Study 1 and Study 2, respectively. Their mean ages were 26.93 (SD = 9.06) and 28.22 (SD = 8.73). In both studies, more than 50% of the participants had a university degree or were current students and fewer than 25% lacked a high school degree (German Abitur). Participants came across the studies by browsing other experiments on www.psytests.de or they were invited via the www.psytests.de mailing list.

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IATs

Both IATs used a standard seven-block procedure (Greenwald et al., 1998; Greenwald, Nosek, & Banaji, 2003). Participants started with single discriminations (20 trials each) of the target concepts ('me' vs. 'other') and the first attribute concepts (e.g. 'conscientious' vs. 'sociable'). This was followed by the combined discrimination of these concepts (divided in one block of 20 and one of 40 trials) and the reversed single discrimination of the attribute concepts (40 trials). Finally, the second combined discrimination employed the reversely paired discrimination of target and attribute concepts (again divided in one block of 20 and one of 40 trials). The IATs differed from the standard procedures only in the following three aspects: First, trials of the combined blocks were presented in a fixed order because we did not want to confound interindividual variance with error variance (cf. Schnabel et al., 2006a). Second, the initial single discrimination of the target concepts was omitted in the second IAT because response key assignment for the target concepts was kept constant throughout both IATs. Third, the reversed single attribute discrimination of the second IAT contained 20 instead of 40 trials. Usually, 40 trials are recommended for this block in order to reduce the effect of order of combined blocks within the IATs (Nosek, Greenwald, & Banaji, 2005). We expected this effect of block order to be already reduced in the second IAT and therefore 20 trials seemed adequate here.

IAT scores were based on the difference in mean response latencies between the two combined blocks of different target–attribute pairings. Scores were calculated as using the D algorithm (Greenwald et al., 2003) without error penalties because participants had to self-correct erroneous responses. Scores in both studies were coded such that high scores represent high conscientiousness. Internal consistencies were estimated over separate scores for the two sub-blocks of the combined discriminations (i.e. one sub-block of 20 and one sub-block of 40 trials) and are reported in the Results section. Attribute stimuli (see Table 1) were selected from Ostendorf's (1994) collection of 823 traits that had been rated for valence, social desirability and Big Five prototypicality. We selected adjectives that were rated as prototypical for their respective Big Five dimensions and balanced the IAT

Table 1. Target and attribute stimuli of the self-concept IATs

Target categories			
I (ICH)	SELF (SELBST)	*OTHERS (ANDERE)*	THEM (FREMD)
MY (MEINE)	ME (MIR)	YOUR (EURE)	YOU (IHR)
OWN (EIGEN)		THEY (EUCH)	

Evaluatively positive attribute categories		
Conscientious (gewissenhaft)[ab]	*Sociable (kontaktfreudig)*[a]	*Agreeable (verträglich)*[b]
Determined (zielstrebig)	Talkative (mitteilsam)	Bighearted (großherzig)
Dutiful (pflichtbewusst)	Gregarious (gesellig)	Amicable (rücksichtsvoll)
Orderly (ordentlich)	Entertaining (unterhaltsam)	Warmhearted (warmherzig)
Disciplined (selbstdiszipliniert)	Communicative (gesprächig)	Docile (gutmütig)
Evaluatively negative attribute categories		
Sloppy (leichtsinnig)[ab]	*Reserved (verschlossen)*[a]	*Selfish (eigennützig)*[b]
Absentminded (wankelmütig)	Reclusive (zugeknöpft)	Egoistic (egoistisch)
Neglectful (nachlässig)	Reticent (zurückhaltend)	Authoritarian (rechthaberisch)
Changeable (wechselhaft)	Inhibited (gehemmt)	Quarrelsome (zänkisch)
Chaotic (chaotisch)	Shy (schüchtern)	Greedy (habsüchtig)

Note: Category labels are *in italics*, original German stimuli are (in parentheses).
[a]Categories of Study 1.
[b]Categories of Study 2.

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categories for social desirability and valence. One adjective (unterhaltsam, engl. entertaining) was added as a self-generated synonym to the category 'sociable'.

Explicit self-ratings

IAT attribute stimuli were presented as five evaluatively positive attribute contrasts (e.g. orderly vs. gregarious in Study 1; e.g. orderly vs. bighearted in Study 2) and five evaluatively negative attribute contrasts (e.g. chaotic vs. shy in Study 1; e.g. chaotic vs. egoistic in Study 2). Participants rated, on a scale ranging from 1–6, the extent to which they judged themselves as either conscientious or sociable (conscientious or agreeable in Study 2). Items were coded such that high scores represent participants who judged their conscientiousness higher than their sociability (or agreeableness).

RESULTS

Descriptive statistics and mean differences

Descriptive statistics and internal consistencies of the main variables are depicted in Table 2. For the IATs, effects of IAT type, IAT order, IAT block order, implicit–explicit order, participant sex and their interactions were tested by a $2 \times 2 \times 2 \times 2 \times 2$ ANOVA with repeated measures on the first factor. There were significant effects of IAT block order in Study 1 and Study 2, $F\ (1185) = 6.65$, $p < .05$, and $F\ (1176) = 17.07$, $p < .001$, respectively. Effects of block order are frequently observed (Greenwald et al., 2003) and indicated higher conscientiousness if the 'me'+'conscientious' pairing was completed first. In Study 2, the main effect of IAT type (positive vs. negative attribute IAT) showed higher conscientiousness for the negative attribute than for the positive attribute IAT (see Table 2), $F\ (1176) = 79.76$, $p < .001$. Thus, participants associated themselves less with conscientiousness when they had to contrast between self-associations with conscientiousness versus agreeableness. However, they associated themselves more with conscientiousness (i.e. non-sloppiness) when they had to contrast between self-associations with selfishness versus sloppiness. This may be attributed to the fact that the negative attribute IAT in Study 2 used stimuli in the category 'selfish' (i.e. 'selfish' and 'egoistic', see Table 1) that are related to and may be more easily associated with the category 'I' than the stimuli of the category 'sloppy'. This, however, results in an IAT effect that indicates

Table 2. Internal consistencies (Cronbach's α) and descriptive statistics of explicit and implicit measures

	Study 1			Study 2		
Variable (range of scale)	α	M	SD	α	M	SD
Explicit self-ratings (1–6)						
Positive attributes	.79	3.41	.98	.76	3.28	.97
Negative attributes	.80	3.50	.85	.64	3.28	.68
IATs (in ms)						
Positive attributes	.80	−.28	207.30	.74	−76.59	211.59
Negative attributes	.81	29.35	198.78	.76	80.67	248.75

Note: All scores were coded such that high scores represent high conscientiousness.

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higher selfishness than sloppiness or, said differently, higher conscientiousness than agreeableness. No other effects were significant for the IATs, and there were no significant effects at all for the explicit self-ratings. In light of the fact that we had no hypotheses on these main effects on *a priori* grounds and because none of these effects influenced the correlations between IATs and explicit measures systematically, we will not discuss these effects on the mean levels of implicit measures further.

Internal consistencies and correlations

Internal consistencies (see Table 2) were satisfactory for all measures except for the explicit attribute contrast employing negative attributes (selfish vs. sloppy) in Study 2. Importantly, all IATs showed satisfactory internal consistencies. IAT error rates were $M = 6.64\%$, $SD = 4.93\%$ and $M = 6.71\%$, $SD = 4.85\%$, for the positive and negative attribute IATs in Study 1, and $M = 6.60\%$, $SD = 4.79\%$ and $M = 7.88\%$, $SD = 5.39\%$, in Study 2, respectively. No participant had error rates higher than 25%. Table 3 shows the correlations between the implicit and explicit variables in Study 1 (above the diagonal) and Study 2 (below the diagonal). In both studies, the explicit self-ratings employing positive trait contrasts were highly correlated with the explicit self-ratings employing negative trait contrasts. Implicit–explicit correlations were weak to moderate.

Finally, correlations between the IATs assessing the identical semantic contrast but using evaluatively different attribute categories were also only moderate whereas the corresponding explicit–explicit correlations were larger. The difference between the explicit–explicit and implicit–implicit correlations was significant in Study 1 ($z = 2.92$, $p < .01$) and Study 2 ($z = 2.57$, $p < .05$) indicating that the explicit self-ratings showed larger convergent validity than the self-concept IATs. This difference between the semantic convergence at the explicit and the implicit level seems to be fully accounted for by the difference in the typical parallel test reliability of the two methods. Whereas the short-term retest and parallel test correlation for multi-item questionnaires is approximately $r = .80$ (Schmidt, Le, & Ilies, 2003), it is approximately .55 for IATs (Schnabel, Greenwald, & Asendorpf, 2008). If the two estimates of semantic convergence at the explicit level (.64 and .55) are averaged using Fisher's *r*-to-*z* transformation, the average convergence was .60, and the estimated 'true' average convergence according to correction for attenuation was .75. The same procedure for the estimates of .45 and .35 at the implicit level resulted in an average convergence of .42 and an estimated 'true' convergence of .76, thus equally high as the convergence at the explicit level.

Table 3. Correlations of explicit and implicit measures

	(1)	(2)	(3)	(4)
Explicit self-ratings				
(1) Positive attributes		.64*	.37*	.33*
(2) Negative attributes	.55*		.38*	.48*
IATs				
(3) Positive attributes	.22*	.21*		.45*
(4) Negative attributes	.05	.25*	.35*	

Note. Correlations above and below the diagonal refer to Study 1 ($N = 201$) and Study 2 ($N = 192$), respectively.
*$p < .05$.

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Relationships within and between implicit and explicit self-concept measures were also explored using Confirmatory Factor Analyses (CFA). Especially, we aimed to test whether latent variable structural models that conceptualised implicit and explicit self-concept as separate factors fitted the data significantly better than models that collapsed indicators of implicit and explicit self-concept into a single factor. In order to define latent variables for the IATs and the explicit self-ratings, all observed variables were split into two halves. For the IATs, we used the identical test halves that were also used for the calculation of the IAT D measures and the calculation of the internal consistencies, that is separate scores for the two sub-blocks of the combined discriminations (cf. Methods section). For the explicit self-ratings, the five item scales were randomly split into two subscales with three or two items, respectively. This resulted in two latent constructs representing the implicit self-concept (i.e. the positive and negative attributes IATs) and two latent constructs representing the explicit self-concept (i.e. the positive and negative attributes ratings) per study. These latent first order factors were subsumed into two-second order factors defining the implicit and the explicit self-concept, when implicit and explicit self-concept were conceptualised as separate factors. Because we conceptualised factors based on positive and negative attributes as equally important, second order paths within explicit and implicit self-concept factors were set equal. Results for the two-factor model are depicted in Figure 1.

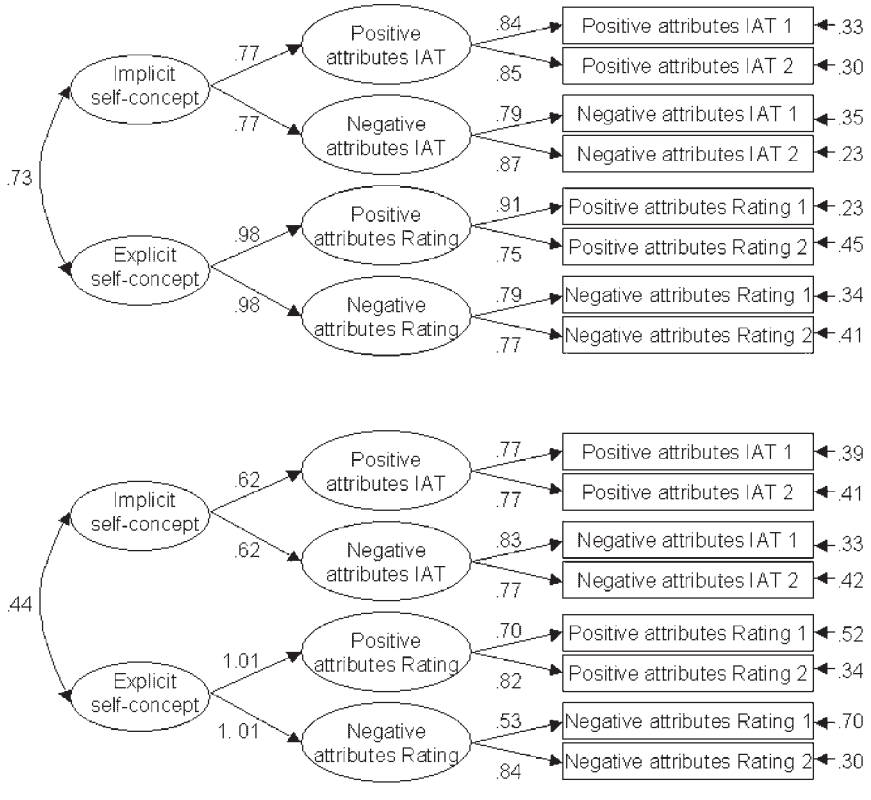

Figure 1. Confirmatory factor analyses of implicit and explicit self-concept as separate factors that were assessed by contrasts of positive and negative personality attributes in Study 1 (upper panel) and Study 2 (lower panel), $\chi^2(17) = 25.81$, $p = .08$, RMSEA = .05, SRMR = .08, GFI = .97 and $\chi^2(17) = 24.71$, $p = .10$, RMSEA = .05, SRMR = .09, GFI = .98, respectively.

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The two-factor solutions showed acceptable model fit both in Study 1 and Study 2, $\chi^2(17) = 25.81$, $p = .08$, RMSEA = .05, SRMR = .08, GFI = .97 and $\chi^2(17) = 24.71$, $p = .10$, RMSEA = .05, SRMR = .09, GFI = .98, respectively. The correlations between the implicit and the explicit self-concept were estimated as moderate to high in both studies. The somewhat higher implicit–explicit correlation in Study 1 than in Study 2 was also reflected by the zero-order correlational pattern of implicit–explicit correlations in Table 3. Considering factor loadings of the first order factors on the implicit versus the explicit self-concept (see left side of Figure 1), relationships within implicit self-concept variables tended to be somewhat weaker than relationships within explicit self-concept variables. This corresponds to differences between the zero order implicit–implicit and explicit–explicit correlations that were already discussed above. It should be noted that correction for attenuation in latent variable structural models corrects the factor loadings for lack of internal consistency of the observed variables but not for their lack of retest reliability. However, it is lack of retest reliability, and especially the somewhat lower retest reliability of IATs as compared to explicit measures, that needs to be corrected for in this case. Latent variable models do not provide a solution to this problem and it seems most useful to follow the more conventional approach from above in order to estimate the 'true' implicit–implicit and explicit–explicit correlations.

When the second order factors of implicit and explicit self-concept were collapsed into a single self-concept factor, the model fit was poorer both in Study 1 and Study 2, $\chi^2(18) = 37.21$, $p = .00$, RMSEA = .07, SRMR = .09, GFI = .96, and $\chi^2(18) = 34.56$, $p = .01$, RMSEA = .07, SRMR = .10, GFI = .96, respectively. Differences in model fit to the two factor model that used separate implicit and explicit self-concept factors were significant in both studies, $\chi^2(1) = 11.40$, $p < .001$ and $\chi^2(1) = 9.85$, $p < .01$. Thus, the implicit and the explicit self-concept could be better conceptualised as separate constructs than as a single self-concept factor.

DISCUSSION

The results of these studies showed that the IAT is suitable for the assessment of specific semantic self-associations that cannot be interpreted as indicators of implicit self-esteem. In two studies, two different IATs that represented the identical semantic contrast with evaluatively different traits were moderately correlated. The results cannot be attributed to valence differences between the attribute categories within the IATs, because the attribute categories were balanced for valence. Nevertheless, the correlations between the IATs were significantly lower than the correlations between the corresponding explicit measures. Additionally, the implicit–implicit correlations were also considerably smaller than the .55 correlation that can be typically expected for IAT parallel or retest correlations (cf. Schnabel et al., 2008). However, this smaller semantic convergence at the implicit level may be due entirely to the lower parallel test reliability of IATs; after disattenuation based on expected unreliabilities, the semantic convergence was virtually identical at the implicit and the explicit level (.76 vs. .75). When relationships within and between implicit and explicit self-concept measures were analysed using CFA, a two-factor model that defined implicit and explicit self-concept as separate but related constructs showed superior model fit. In contrast, a single factor model that collapsed implicit and explicit variables on a single self-concept factor fitted the less well in both studies. This replicates results from the attitude domain showing that models with distinct implicit and explicit factors per attitude

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were superior to models with a single factor per attitude (Nosek & Smyth, 2007). Importantly, this was true for the data of the current studies even though the estimated implicit–explicit correlations were quite large.

The current results extend Perkins and Forehand's (2006) findings that the semantic meaning of self-descriptive attributes rather than their positive or negative valence constitutes the central core of associations between the self and self-descriptive attributes. In their studies, participants showed stronger self-associations for self-descriptive attributes and their oppositely valenced synonyms than for attributes that shared valence but not semantic meaning. Thus, on the level of main effects, they found that self-concept IATs were influenced more by the specific semantic meaning of the attributes than by the attributes' positive or negative valence. The current studies go beyond those findings by finding, at the level of individual differences, that specific semantic self-associations in a positive IAT are as strongly correlated with specific semantic self-associations in a negative IAT as are explicit positive and negative measures.

Results of the current studies also extend Amodio and Devine's (2006) findings in showing the validity of non-evaluative associations in two much larger samples than those of their Studies 2 and 3. However, the current studies only studied the convergent validity between different IATs and did not explore the behavioural validity of the self-concept IATs. As a first step, it seemed necessary to demonstrate the validity of self-concept IATs for specific semantic contrasts at the level of interindividual differences. Future studies may explore the predictive validity of implicit semantic self-associations for the prediction of behaviour and their incremental validity over and above explicit self-report measures. Additionally, future study designs may include a self-esteem IAT (Greenwald & Farnham, 2000) in order to assess the degree of contamination due to implicit self-esteem. This also allows to assess the incremental validity of the non-bipolar IAT variants over and above the standard self-esteem IAT.

Using non-bipolar semantic contrasts (e.g. 'conscientious' vs. 'sociable') appears to be an effective alternative to standard bipolar IATs when the two attribute categories of an IAT would otherwise be confounded with positive or negative valence. Non-bipolar IATs may be especially useful when it is difficult to find evaluatively neutral or balanced synonyms for opposed attribute categories in an IAT. For instance, it is difficult to find negatively valenced synonyms for the personality traits extraversion or agreeableness, or positively valenced synonyms for anxiousness and angriness. Non-bipolar IATs may be useful in job application settings when the interest is in learning whether applicants have stronger self-associations with conscientiousness than with sociability, or with achievement than with affiliation motives. It should be noted, however, that non-bipolar IATs are characterised by a feature that is inherent in all IATs, namely that IATs assess relative association strengths. In the current studies, participants showed high IAT scores when they associated themselves faster with conscientiousness relatively to sociability (Study 1) or agreeableness (Study 2). Thus, valence contamination was avoided by including the contamination that two personality traits were simultaneously and inseparably assessed within the IATs. As noted before, we nevertheless expect that non-bipolar IATs will be useful in domains that are especially interested in the comparison of association strengths for different traits.

The present findings are encouraging because they suggest that IAT effects are as much based on semantic content, after controlling for evaluative meaning, as are explicit self-ratings. However, the results also showed that the relatively low retest and parallel test reliabilities for IATs (Schnabel et al., 2008) reduce the convergent validity between

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semantically parallel IATs. This lower convergence at the manifest level should not be misinterpreted as a stronger influence of evaluative content on IATs—it may reflect only lower parallel test reliability.

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