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Temporal Stability of Implicit and Explicit Measures: A Longitudinal Analysis

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Abstract

A common assumption about implicit measures is that they reflect early experiences, whereas explicit measures are assumed to reflect recent experiences. This assumption subsumes two distinct hypotheses: (a) Implicit measures are more resistant to situationally induced changes than explicit measures; (b) individual differences on implicit measures are more stable over time than individual differences on explicit measures. Although the first hypothesis has been the subject of numerous studies, the second hypothesis has received relatively little attention. The current research addressed the second hypothesis in two longitudinal studies that compared the temporal stability of individual differences on implicit and explicit measures in three content domains (self-concept, racial attitudes, political attitudes). In both studies, implicit measures showed significantly lower stability over time (weighted average r = .54) than conceptually corresponding explicit measures (weighted average r = .75), despite comparable estimates of internal consistency. Implications for theories of implicit social cognition and interpretations of implicit and explicit measures are discussed.

Keywords

attitudes, implicit measures, longitudinal analysis, self-concept, temporal stability

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It is quite difficult to find references to psychoanalytic concepts in contemporary social psychology. Yet, there are some popular ideas that have considerable resemblance to the assumptions of psychoanalytic theory. One such idea is the hypothesis that traces of past experiences may linger in the unconscious after people revised their conscious beliefs in response to recent experiences (Greenwald & Banaji, 1995; Rudman, 2004; Wilson, Lindsey, & Schooler, 2000). This hypothesis is most prevalent in the field of implicit social cognition (for a review, see Gawronski & Payne, 2010), in which dissociations between implicit and explicit measures are often attributed to a lack of introspective access to traces of past experiences. The basic assumption is that implicit measures provide a window to unconscious representations that have their roots in early experiences, whereas explicit measures capture more recently acquired, conscious representations (for a critical discussion, see Gawronski, LeBel, & Peters, 2007).

Although the claim that implicit measures tap into unconscious representations has been challenged by research showing that people are able to predict their scores on implicit measures with a high level of accuracy (Hahn, Judd, Hirsh, & Blair, 2014), theoretical interpretations in terms of early versus recent experiences are still very common (e.g., Anglin, 2015; Baron & Banaji, 2006; Gregg, Seibt, & Banaji, 2006; Rudman, Phelan, & Heppen, 2007; Rydell, McConnell, Strain, Claypool, & Hugenberg, 2007; but see Castelli, Carraro, Gawronski, & Gava, 2010). Conceptually, such interpretations involve two related, yet empirically distinct, hypotheses: (1) Implicit measures are more resistant to situationally induced changes than explicit measures; (2) Individual differences on implicit measures are more stable over time than individual differences on explicit measures.

Although the first hypothesis has been the subject of numerous studies (for a review, see Gawronski & Sritharan, 2010), the second hypothesis has received relatively little attention. In the current research, we tested the second hypothesis by comparing the temporal stability of individual differences on implicit and explicit measures in three content

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domains (self-concept, racial attitudes, political attitudes) for time intervals of 1 to 2 months.

Resistance to Situationally Induced Changes

A common assumption in research using implicit measures is that they capture traces of past experiences that are relatively resistant to change. This hypothesis has been advanced by theories assuming that attitudes are not erased from memory when novel experiences lead to attitude change (e.g., Petty, Tormala, Briñol, & Jarvis, 2006; Wilson et al., 2000). According to these theories, newly acquired attitudes usually override the impact of old attitudes on explicit measures. Yet, implicit measures are assumed to limit people's ability to retrieve the new attitude from memory, allowing the old attitude to shape evaluative responses on the measure. These assumptions are consistent with research showing that many well-known manipulations of attitude change influence responses on explicit, but not implicit, measures (e.g., Gawronski & Strack, 2004; Gregg et al., 2006). However, there is also a large body of research showing the opposite pattern (e.g., Gawronski & LeBel, 2008; Gibson, 2008; Grumm, Nestler, & von Collani, 2009; Olson & Fazio, 2006; Strick, van Baaren, Holland, & van Knippenberg, 2009). These disparate findings inspired the development of new theories that specify the conditions under which a given factor should lead to (a) change on explicit, but not implicit, measures; (b) change on implicit, but not explicit, measures; and (c) change on both explicit and implicit measures.

One example is the associative–propositional evaluation (APE) model (Gawronski & Bodenhausen, 2006, 2011), which attributes asymmetric effects on implicit and explicit measures to the differential involvement of associative and propositional processes. According to the APE model, associative processes involve the activation of associations on the basis of feature similarity and spatio-temporal contiguity; propositional processes involve the validation of activated information on the basis of cognitive consistency. For example, repeated pairings of a conditioned stimulus (CS) with a positive or negative unconditioned stimulus (US) are assumed to influence evaluative responses to the CS on implicit measures via the formation of associative links, and these newly formed associations may or may not be regarded as a valid basis for evaluative judgments on explicit measures. As a result, CS–US pairings should lead to changes in CS evaluations on implicit measures, which may generalize to explicit measures to the extent that the newly created associations are regarded as valid (e.g., Gawronski & LeBel, 2008; Grumm et al., 2009). Conversely, newly acquired verbal information is assumed to influence evaluative judgments on explicit measures if it passes a propositional process of validity assessment, and this process may or may not result in the formation of corresponding associative links that influence responses on implicit measures (e.g., Whitfield & Jordan, 2009). Although there are several other theories that aim to explain asymmetric effects on implicit and explicit measures (e.g., Petty, Briñol, & DeMarree, 2007; Rydell & McConnell, 2006), a shared assumption of these theories is that, depending on various conditions, implicit measures can be more or less resistant to situationally induced changes than explicit measures, which is consistent with the diversity of findings in the literature (for a review, see Gawronski & Bodenhausen, 2006).

Temporal Stability of Individual Differences

Although the available evidence suggests that implicit measures are less resistant to situationally induced changes than explicit measures under certain conditions (e.g., Gawronski & LeBel, 2008; Gibson, 2008; Grumm et al., 2009; Olson & Fazio, 2006; Strick et al., 2009), the observation of such changes does not necessarily question a persistent impact of early experiences. After all, it is possible that experimental effects on implicit measures reflect situationally induced shifts that are still anchored in early experiences. This issue has been a prominent source of confusion in debates between social and personality psychologists, in that experimental effects on a given measure do not conflict with a simultaneous influence of stable trait-related factors. As noted repeatedly in the person-situation debate (e.g., Funder, 2006), the two sources of variance can be independent, in that situational factors may cause systematic shifts in mean values without affecting the rank order of individual differences. Along the same lines, evidence for situationally induced changes on implicit measures does not rule out a persistent impact of early experiences that remains stable over time. The latter question cannot be answered with experimental data, but requires longitudinal investigations on the temporal stability of individual differences.

An important aspect in this context concerns the theoretical meaning of mean values and rank orders of individual differences in longitudinal studies. In a strict sense, equivalent sample means over time do not speak to the stability of individual differences, because stable mean values at the sample level may conceal fluctuations at the individual level. For example, in a study on racial attitudes before and after the 2008 U.S. presidential election, Schmidt and Nosek (2010) found that the average levels of racial bias on implicit and explicit measures barely changed during Barack Obama's presidential campaign and his early presidency. However, a lack of change in mean values does not imply that racial attitudes were stable over time. After all, it is possible that racial attitudes became more favorable for some participants and less favorable for others, producing equivalent sample means over the period of the study.

Conversely, even if Schmidt and Nosek (2010) had found changes in mean values over time, such changes would not necessarily conflict with a high stability of individual

differences. As explained above, early experiences may continue to influence responses on implicit measures even when situational factors have led to an overall shift in mean values at the sample level (Funder, 2006). For example, participants who initially showed high levels of racial bias may continue to show scores at the top of the distribution even when there has been a significant decrease in the average level of bias over time, whereas those who initially showed low levels of racial bias may continue to show scores at the bottom of the distribution. In this case, it would be premature to dismiss a persistent impact of early experiences on the basis of mean level changes at the sample level. After all, a person's current level of bias would be systematically related to that person's earlier level of bias, suggesting a high degree of temporal stability at the level of individual differences despite the observed change in mean values. Together, these considerations imply that (a) stable mean values at the sample level do not imply high stability of individual differences, and (b) there can be high stability of individual differences even when there is an overall shift in mean values at the sample level. From this perspective, questions about the temporal stability of individual differences on implicit and explicit measures cannot be answered on the basis of mean values, but require correlational analyses regarding the stability of rank orders over time.

Another important issue in this context concerns the internal consistency of implicit measures. Psychometrically, the internal consistency of a measure constrains its potential relation to other measures, including relations to the same measure at a different time. To the extent that the internal consistency of a given measure is low, its relation to other measures will generally be low due to random measurement error. However, low relations resulting from random error should not be confused with a weak relation of the measured constructs. This issue is essential in the context of the current research, because many implicit measures suffer from low internal consistencies (Gawronski & De Houwer, 2014). To avoid potential distortions of our findings, the current research focused on two implicit measures that have shown internal consistencies that meet the typical psychometric standards for explicit measures: the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998) and the Affect Misattribution Procedure (AMP; Payne, Cheng, Govorun, & Stewart, 2005). By ensuring comparable internal consistencies for implicit and explicit measures, our studies allow for stronger conclusions regarding the temporal stability of individual differences on implicit and explicit measures.

The Present Research

To test the hypothesis that implicit measures are more sensitive to early experiences than explicit measures, we conducted two longitudinal studies that investigated the stability of individual differences on implicit and explicit measures over time. Each study included two measurement points that were 1 to 2 months apart. The first study investigated the temporal stability of implicit and explicit measures of the self-concept using the IAT (Study 1a) and racial attitudes using the AMP (Study 1b); the second study investigated the temporal stability of implicit and explicit measures of political attitudes using the AMP (Study 2a) and racial attitudes using the IAT (Study 2b). To avoid potential confounds between type of measure and measured constructs, both studies aimed to maximize the conceptual correspondence between the two kinds of measures (see Hofmann, Gawronski, Gschwendner, Le, & Schmitt, 2005; Payne, Burkley, & Stokes, 2008). If implicit measures are more sensitive to early experiences than explicit measures, individual differences on implicit measures should show higher levels of temporal stability than individual differences on explicit measures. The current studies provide clear evidence against this hypothesis, showing higher levels of temporal stability for explicit than implicit measures.

Study 1a: Self-Concept IAT

Method

Participants. A total of 194 first-year undergraduate students at the University of Western Ontario in Canada were recruited through posters and flyers on campus. All participants completed the first session of the data collection in September 2013.[1] Approximately 2 months after the first session, participants were contacted via email with an invitation to participate in the second session. A total of 156 participants returned for the second session (80.4%). Due to mismatches in individual code numbers (see below), Time 2 data from four participants could not be matched to their Time 1 data. This left us with a final sample of 152 participants (107 women, 45 men) for the longitudinal analysis. Participants' age in the final sample ranged from 17 to 22 (M = 18.07, SD = 0.68). All measures were completed in individual testing rooms at both measurement points, which were approximately 2 months apart. Participants received a compensation of CAD$10 for each of the two sessions. As an additional incentive to return for the second session, participants who completed both sessions were entered in a draw for one of 10 CAD$50 Amazon gift cards.

Procedure. The study was introduced as an investigation of personality and social attitudes of students during the first year of university. Participants were told that they will be asked to answer survey questions about their personality and social attitudes and to categorize words and images as quickly as possible. To match participants' responses at the two measurement times, they were asked to report the last four digits of their primary phone number at the end of each session. The order of the measures was held constant at the two measurement points, in that all participants first completed the explicit measure and then the implicit measure.

Implicit measure. The implicit measure was an introversion–extraversion IAT adapted from Peters and Gawronski (2011).

Table 1. Internal Consistency, Means, Standard Deviations, and Stability of Implicit and Explicit Measures as a Function of Measurement Time.

		Time 1			Time 2			Stability	
Measure	Type	α	*M*	*SD*	α	*M*	*SD*	*r*	*p*
Study 1a: Self-concept (*N* = 152)									
Implicit Association Test	Implicit	.79	0.37	0.47	.87	0.39	0.52	.63	<.001
Attribute Rating	Explicit	.83	3.35	0.64	.86	3.38	0.66	.83	<.001
Study 1b: Racial attitudes (*N* = 152)									
Affect Misattribution Procedure	Implicit	.67	0.06	0.21	.74	0.04	0.19	.38	<.001
Feeling Thermometer	Explicit	—	0.45	1.67	—	0.34	1.69	.52	<.001
Egalitarian Goals	Explicit	.83	3.99	0.66	.82	3.86	0.58	.67	<.001
Perceived Discrimination	Explicit	.87	3.20	0.71	.90	3.28	0.74	.74	<.001
Study 2a: Political attitudes (*N* = 116)									
Affect Misattribution Procedure (relative preference)	Implicit	.82	0.13	0.29	.84	0.12	0.26	.64	<.001
Affect Misattribution Procedure (Clinton)	Implicit	.74	−0.01	0.24	.77	0.00	0.24	.58	<.001
Affect Misattribution Procedure (Trump)	Implicit	.75	−0.14	0.27	.78	−0.12	0.24	.57	<.001
Evaluative Ratings (relative preference)	Explicit	.97	2.69	1.92	.97	2.66	1.93	.81	<.001
Evaluative Ratings (Clinton)	Explicit	.96	4.49	1.37	.96	4.37	1.42	.80	<.001
Evaluative Ratings (Trump)	Explicit	.96	1.80	1.17	.95	1.72	1.06	.68	<.001
Study 2b: Racial attitudes (*N* = 116)									
Implicit Association Test	Implicit	.71	0.42	0.41	.69	0.46	0.42	.44	<.001
Evaluative Ratings (exemplars)	Explicit	.90	−0.14	1.26	.84	0.04	1.07	.88	<.001
Semantic Differential (category)	Explicit	.93	−0.47	1.41	.93	−0.31	1.43	.81	<.001

In the first block of the task, participants were presented with self-related words (i.e., *I*, *me*, *my*, *mine*, *self*) and self-unrelated words (i.e., *few*, *some*, *any*, *it*, *other*) in the center of the screen and asked to press a right-hand key (*Numpad 5*) labeled *Me* when they saw a self-related word and a left-hand key (*A*) labeled *Not Me* when they saw a self-unrelated word. In the second block, words related to extraversion (i.e., *active*, *talkative*, *sociable*, *outgoing*, *assertive*) and introversion (i.e., *passive*, *quite*, *withdrawn*, *private*, *reserved*) had to be assigned to the categories *extravert* (right-hand key) and *introvert* (left-hand key). In the third block, target and attribute trials were presented in alternating order, with self-related and extraversion words requiring a response with the right-hand key and self-unrelated and introversion words requiring a response with the left-hand key. In the fourth block, participants practiced categorizing extraversion and introversion words with a reversed key assignment. In the fifth block, target and attribute trials were again combined, with self-related and introversion words requiring a response with the right-hand key and self-unrelated and extraversion words requiring a response with the left-hand key. Blocks 1, 2, and 4 consisted of 20 trials, and Blocks 3 and 5 consisted of 80 trials. The intertrial interval was 250 ms. Following incorrect responses, the word *ERROR!* was presented for 1,000 ms in the center of the screen.

Explicit measure. The explicit measure asked participants to rate themselves on the 10 attribute words of the IAT (Peters & Gawronski, 2011). On each item, participants were presented with a statement that described themselves in terms of a particular attribute (e.g., *I am reserved*) and asked to indicate their agreement with the statement on 5-point rating scales ranging from 1 (*strongly disagree*) to 5 (*strongly agree*).

Results and Discussion

IAT scores were aggregated with Greenwald, Nosek, and Banaji's (2003) D-algorithm, such that higher scores indicate higher levels of extraversion. The attribute ratings were aggregated by reverse coding the five items capturing introversion and then averaging participants' responses in a single score of extraversion. Means, standard deviations, and estimates of internal consistency (Cronbach's α) of all measures at the two measurement times are reported in Table 1.[2] The two measures revealed comparable Cronbach's α values at a satisfactory level. Comparing self-concept scores across the two measurement times, neither the implicit measure, $t(151) = 0.34$, $p = .73$, $d = 0.035$, nor the explicit measure, $t(151) = 0.89$, $p = .37$, $d = 0.072$, showed significant differences in mean values over time. Yet, the two measures did differ in terms of their stability over time (see Table 1), such that the explicit measure showed a significantly higher correlation between the two measurement times than the implicit measure, $Z = 5.45$, $p < .001$.[3] This result poses a challenge to the hypothesis that implicit measures are more sensitive to early experiences than explicit measures, which implies that implicit measures should show higher temporal stability of individual differences than explicit measures.[4]

Study 1b: Racial Attitudes AMP

Method

Participants and procedure. The data for Study 1b were collected in the same two longitudinal sessions as Study 1a. After participants completed the self-concept measures of Study 1a, they were asked to perform a working memory task that is unrelated to the purpose of the current analysis. After the working memory task, participants completed the racial attitude measures of Study 1b as the third and final part of the battery. The order of the measures was held constant at the two measurement points, in that all participants first completed the implicit measure and then the explicit measures.

Implicit measure. The implicit measure was a racial attitudes AMP adapted from Gawronski, Peters, Brochu, and Strack (2008). On each trial of the task, participants were first presented with a fixation cross for 500 ms, which was replaced by a picture of the face of either a Black or a White man for 200 ms. The presentation of the prime stimuli was followed by a Chinese ideograph, which was replaced by a black-and-white pattern mask after 100 ms. Upon presentation of the pattern mask, participants were asked to indicate whether they considered the presented ideograph as more pleasant or less pleasant than the average Chinese ideograph. The pattern mask remained on the screen until participants gave their response. Participants were asked to press a right-hand key (*Numpad 5*) if they considered the Chinese ideograph as more pleasant than the average Chinese ideograph, and a left-hand key (*A*) if they considered the Chinese ideograph as less pleasant than average. Following Payne et al. (2005), participants were told that the faces can sometimes bias people's responses to the Chinese ideograph, and that they should try their absolute best not to let the faces influence their judgments of the Chinese ideographs. As prime stimuli, we used pictures of 10 Black and 10 White male faces. Each face was presented 4 times during the task, summing up to a total of 80 trials. As target stimuli, we used a pool of 160 Chinese ideographs, which were randomly selected by the computer. Order of trials was randomized for each participant.

Explicit measures. Participants were asked to rate their feelings toward various social groups, including Blacks and Whites. Responses on the feeling thermometer were measured with 7-point rating scales ranging from 1 (*very cold*) to 7 (*very warm*). For exploratory purposes, the study also included explicit measures of egalitarian goals and perceptions of racial discrimination, both adapted from Gawronski et al. (2008). A sample item of the egalitarian goals scale is *I feel guilty when I have negative thoughts or feelings about the members of disadvantaged minority groups*. A sample item of the perceived discrimination scale is *Black people in Canada often miss out on good jobs due to racial discrimination*. Responses were measured with 5-point rating scales ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Because egalitarian goals and perceptions of discrimination do not conceptually correspond to the racial attitudes measured by the AMP (see Hofmann et al., 2005; Payne et al., 2008), our conclusions about temporal stability are exclusively based on the comparison between AMP scores and feeling thermometer ratings. The results for egalitarian goals and perceptions of discrimination are reported for the sake of comprehensiveness.

Results and Discussion

AMP scores were aggregated by calculating the proportion of *more pleasant* responses for each of the two prime categories (i.e., Black, White). A single score of preference for Whites over Blacks was calculated by subtracting the proportion of *more pleasant* responses on Black priming trials from the proportion of *more pleasant* responses on White priming trials. Feeling thermometer ratings were combined into a corresponding index by subtracting the mean positivity ratings for Blacks from the mean positivity ratings for Whites. Ratings on the perceived discrimination and egalitarian goals scales were aggregated by reverse coding items with a negative polarization and then calculating the mean values for each of the two scales. Ratings were aggregated such that higher values indicate higher perceived discrimination and stronger egalitarian goals, respectively. Means, standard deviations, and estimates of internal consistency (Cronbach's α) of all measures at the two measurement times are reported in Table 1.[5] All measures revealed comparable Cronbach's α values at a satisfactory level. Comparing mean values across the two measurement times, neither AMP scores, $t(151) = 1.01$, $p = .31$, $d = 0.082$, nor feeling thermometer scores, $t(151) = 0.84$, $p = .40$, $d = 0.068$, showed significant differences over time. Whereas egalitarian goals showed a statistically significant reduction over time, $t(151) = 3.15$, $p = .002$, $d = 0.275$, perceived discrimination showed a marginally significant increase, $t(151) = 1.93$, $p = .06$, $d = 0.156$. More importantly, AMP scores showed significantly lower stability over time than feeling thermometer scores, $Z = 2.15$, $p = .03$ (see Table 1). Overall, AMP scores showed the lowest stability and perceived discrimination the highest stability. Feeling thermometer ratings and egalitarian goals showed stability levels in-between, with egalitarian goals showing slightly higher stability than feeling thermometer scores. The correlations between the two measurement times were significantly lower for the AMP compared with all three explicit measures, all Zs > 2.15, all ps < .03. These results conceptually replicate the findings of Study 1a and further indicate that the lower temporal stability obtained for implicit measures generalizes to the AMP and to measures of racial attitudes.[6]

Interim Discussion

The results of Studies 1a and 1b stand in contrast to the hypothesis that implicit measures are more sensitive to early

experiences than explicit measures. A central implication of this hypothesis is that individual differences on implicit measures should show higher levels of stability over time than individual differences on explicit measures. Counter to this prediction, we found higher levels of temporal stability for explicit than implicit measures. This finding contradicts the widespread assumption that implicit measures provide superior access to early experiences than explicit measures (e.g., Anglin, 2015; Baron & Banaji, 2006; Gregg et al., 2006; Rudman et al., 2007; Rydell et al., 2007). If anything, our findings suggest that responses on explicit measures are more strongly anchored in the past, whereas implicit measures show more fluctuation over time.[7]

Although our main finding replicated in two content domains with two widely used implicit measures, an important limitation is that the implicit measures were not 100% identical at the two measurement times. Following a common practice in the literature, the stimulus selection in the implicit measures was randomized for each participant at each of the two measurement times. Thus, it is possible that test–retest correlations for the implicit measures were suppressed by procedural differences between the two measurement times. To rule out this concern, we conducted a second longitudinal study in which the stimulus selection in the implicit measures was randomized a priori and held constant for all participants at both measurement times. To provide further evidence for the generality of the obtained asymmetry, the second study investigated the temporal stability of implicit and explicit measures of political attitudes using the AMP (Study 2a) and racial attitudes using the IAT (Study 2b).

Study 2a: Political Attitudes AMP

Method

Participants. A total of 164 students at the University of Texas at Austin were recruited through posters and flyers on campus. All participants completed the first session of the data collection between January 25 and March 11, 2016.[8] Approximately 1 month after the first session, participants were contacted via email with an invitation to participate in the second session. A total of 120 participants returned for the second session (73.2%). Due to mismatches in individual code numbers (see below), Time 2 data from four participants could not be matched to their Time 1 data. This left us with a final sample of 116 participants (96 women, 20 men) for the longitudinal analysis. Participants' age in the final sample ranged from 18 to 53 (M = 22.59, SD = 5.78). All measures were completed in individual testing rooms at both measurement times, which were approximately 1 month apart. Participants received a compensation of US$10 for each of the two sessions. As an additional incentive to return for the second session, participants who completed both sessions were entered in a draw for one of three US$50 Amazon gift cards.

Procedure. The study was introduced as an investigation of social attitudes and preferences. Participants were told that they will be asked to answer survey questions about their social and political attitudes and to categorize words and images as quickly as possible. To match participants' responses at the two measurement times, they were asked to create a six-digit code consisting of the second letter of their first name, the first letter of their birth town, the day of their birth (using "0" as the first number if it has only one digit), the last letter of their last name, and the first letter of their mother's first name. Participants were asked to indicate their personal code at the end of each session. The order of the measures was held constant at the two measurement points, in that all participants first completed the explicit measure and then the implicit measure.

Implicit measure. The implicit measure was an AMP designed to assess attitudes toward Hillary Clinton and Donald Trump, the two frontrunners in the Democratic and Republican primaries for the 2016 U.S. Presidential Election at the time of the data collection. On each trial of the task, participants were first presented with a fixation cross for 500 ms, which was replaced by a picture of either Hillary Clinton or Donald Trump for 75 ms. After a blank screen for 125 ms, a Chinese ideograph was presented for 100 ms, which was replaced by a black-and-white pattern mask. Upon presentation of the pattern mask, participants were asked to indicate whether they considered the presented ideograph as more pleasant or less pleasant than the average Chinese ideograph. The pattern mask remained on the screen until participants gave their response. Participants were asked to press a right-hand key (*Numpad 5*) if they considered the Chinese ideograph as more pleasant than the average Chinese ideograph, and a left-hand key (*A*) if they considered the Chinese ideograph as less pleasant than average. Following Payne et al. (2005), participants were told that the faces can sometimes bias people's responses to the Chinese ideographs, and that they should try their absolute best not to let the faces influence their judgments of the ideographs. As prime stimuli, we used 10 pictures of Hillary Clinton and 10 pictures of Donald Trump, each of which was presented 3 times during the task. To allow for a calculation of individual priming scores for each of the two candidates, the AMP additionally included 30 trials with a gray square as a baseline prime, summing up to a total of 90 trials. As target stimuli, we used a pool of 90 Chinese ideographs. Order of trials and prime-target pairs was randomized a priori and held constant for all participants and both measurement times.

Explicit measure. The explicit measure asked participants to rate their feelings toward Hillary Clinton and Donald Trump

on three 7-point scales with the end points *very negative* versus *very positive*, *very unpleasant* versus *very pleasant*, and *very bad* versus *very good*. To further increase the correspondence between the stimuli in the two kinds of measures, each item was presented together with a collage of the 10 pictures of Hillary Clinton or the 10 pictures of Donald Trump, respectively.

Results and Discussion

AMP data were aggregated by first calculating the proportion of *more pleasant* responses for the two types of primes (i.e., Clinton, Trump) and the neutral baseline prime (i.e., gray square). A score of relative preference for Clinton over Trump was calculated by subtracting the proportion of *more pleasant* responses on trials with Trump as a prime from the proportion of *more pleasant* responses on trials with Clinton as a prime. In addition to the relative preference score, we calculated individual priming scores for Clinton and Trump, respectively. Individual priming scores for Clinton were calculated by subtracting the proportion of *more pleasant* responses on trials with a gray square as a prime from the proportion of *more pleasant* responses on trials with Clinton as a prime. Correspondingly, individual priming scores for Trump were calculated by subtracting the proportion of *more pleasant* responses on trials with a gray square as a prime from the proportion of *more pleasant* responses on trials with Trump as a prime. Explicit scores were aggregated accordingly by calculating the mean ratings of Clinton and Trump, respectively. Using the two individual scores, an index of relative preference for Clinton over Trump was calculated by subtracting the mean ratings of Trump from the mean ratings of Clinton. Means, standard deviations, and estimates of internal consistency (Cronbach's α) of all measures at the two measurement times are reported in Table 1.[9] All measures revealed comparable Cronbach's α values at a satisfactory level. Comparing mean values across the two measurement times, none of the three AMP scores showed significant differences over time, all ts < 0.87, all ps > .38, all ds < 0.081. The same was true for the three explicit scores, all ts < 1.47, all ps > .14, all ds < 0.137. More importantly, each of the three AMP scores showed lower stability over time compared with their corresponding explicit scores, with $Z = 3.89$, $p < .001$, for relative preference scores; $Z = 4.56$, $p < .001$, for Clinton scores; and $Z = 1.95$, $p = .05$, for Trump scores (see Table 1). These results replicate the finding of Studies 1a and 1b, further showing that the lower temporal stability obtained for implicit measures generalizes to the domain of political attitudes. Moreover, because Study 2a used an a priori stimulus randomization that was held constant for all participants at both measurement times, the current findings rule out concerns that test–retest correlations for implicit measures in Studies 1a and 1b might have been suppressed by procedural differences between the two measurement times.[10]

Study 2b: Racial Attitudes IAT

Method

Participants and procedure. The data for Study 2b were collected in the same two longitudinal sessions as Study 2a. Participants first completed the political attitude measures of Study 2a, and were then asked to complete the racial attitude measures of Study 2b. The order of the measures was held constant at the two measurement points, in that all participants first completed the implicit measure and then the explicit measures.

Implicit measure. The implicit measure was a racial attitude IAT adapted from Gawronski et al. (2008). In the first block of the task, participants were presented with 10 Black faces and 10 White faces in the center of the screen and asked to press a right-hand key (*Numpad 5*) labeled *White* when they saw a White face and a left-hand key (*A*) labeled *Black* when they saw a Black face. In the second block, five positive words (i.e., *good*, *pleasant*, *likable*, *nice*, *friendly*) and five negative words (i.e., *bad*, *unpleasant*, *dislikable*, *nasty*, *unfriendly*) had to be assigned to the categories *positive* (right-hand key) and *negative* (left-hand key). In the third block, target and attribute trials were presented in alternating order, with White faces and positive words requiring a response with the right-hand key and Black faces and negative words requiring a response with the left-hand key. In the fourth block, participants practiced categorizing Black and White faces with a reversed key assignment. In the fifth block, target and attribute trials were again combined, with Black faces and positive words requiring a response with the right-hand key and White faces and negative words requiring a response with the left-hand key. Blocks 1 and 2 consisted of 20 trials, Block 4 consisted of 40 trials, and Blocks 3 and 5 consisted of 60 trials (see Greenwald et al., 2003). The intertrial interval was 250 ms. Following incorrect responses, the word *ERROR!* was presented in the center of the screen for 1,000 ms. Order of trials was randomized a priori and held constant for all participants and both measurement times.

Explicit measures. Because the IAT is sensitive to both the category labels in the task (e.g., De Houwer, 2001) and the stimuli used as individual exemplars (e.g., Bluemke & Friese, 2006), the current study included two explicit measures: one assessing category evaluations and the other assessing exemplar evaluations. To measure exemplar evaluations, participants were asked to rate their feelings toward the Black and White faces of the IAT (see Gawronski et al., 2008). Responses were measured with 7-point rating scales ranging from 1 (*very negative*) to 7 (*very positive*). To measure category evaluations, we used a semantic differential in which participants were asked to indicate their personal views about African Americans and White Americans on 7-point scales using the bipolar adjective pairs of the IAT

(i.e., *bad–good*, *unpleasant–pleasant*, *dislikable–likable*, *nasty–nice*, *unfriendly–friendly*).

Results and Discussion

IAT scores were aggregated with Greenwald et al.'s (2003) D-algorithm, such that higher scores indicate a stronger preference for Whites over Blacks. Explicit exemplar evaluations were aggregated by subtracting the mean ratings of Black faces from the mean ratings of Whites faces. A score of explicit category evaluations was calculated by subtracting the mean semantic differential ratings of African Americans from the semantic differential ratings of Whites Americans. Means, standard deviations, and estimates of internal consistency (Cronbach's α) of all measures at the two measurement times are reported in Table 1.[11] The three indices revealed comparable Cronbach's α values at a satisfactory level. Comparing the mean scores across the two measurement times, both explicit measures showed significantly lower scores at Time 1 than Time 2, $t(115) = 2.04$, $p = .04$, $d = 0.190$, for explicit category evaluations, and $t(115) = 3.26$, $p = .001$, $d = 0.318$, for explicit exemplar evaluations. There was no significant difference in mean values for the IAT, $t(115) = 0.98$, $p = .33$, $d = 0.091$. Yet, the three measures did differ in terms of their stability over time (see Table 1), such that the two explicit measures showed a significantly higher correlation between the two measurement times than the IAT, with $Z = 9.40$, $p < .001$, for exemplar evaluations, and $Z = 7.05$, $p < .001$, for category evaluations. Together, these results corroborate the conclusion that implicit measures show lower stability over time than explicit measures, which poses a challenge to the assumption that implicit measures are more sensitive to early experiences than explicit measures. If anything, our findings suggest that responses on explicit measures are more strongly anchored in the past than responses on implicit measures.[12]

Reanalysis of Published Data

To further investigate the temporal stability of implicit measures, we conducted a literature search for published studies that administered the same implicit measure more than once with a delay of at least 1 day. Table 2 provides an overview of the identified studies and their main findings. Despite considerable variation in terms of topics, time intervals, and measures, the weighted average stability of implicit measures across these studies is $r = .41$, which is slightly lower than the weighted average stability of $r = .54$ obtained in the current studies. Seven of the studies in Table 2 also included corresponding explicit measures (Bosson, Swann, & Pennebaker, 2000; Cunningham, Preacher, & Banaji, 2001; Dasgupta & Greenwald, 2001; Devine, Forscher, Austin, & Cox, 2012; Galdi, Arcuri, & Gawronski, 2008; Galdi, Gawronski, Arcuri, & Friese, 2012; Steffens & Buchner, 2003). In these studies, the temporal stability of implicit and explicit measures revealed a similar picture, with a weighted average correlation of $r = .34$ for implicit measures and a weighted average correlation $r = .81$ for explicit measures.[13] When these data were combined with the data of the current studies, implicit measures showed a weighted average stability of $r = .42$ and explicit measures showed a weighted average stability of $r = .78$. Together, these results provide further support for our conclusion that implicit measures show lower stability over time than explicit measures, which conflicts with the assumption that implicit measures are more sensitive to early experiences than explicit measures.

General Discussion

The main goal of the current research was to test the hypothesis that implicit measures are more sensitive to early experiences than explicit measures. A central implication of this hypothesis is that individual differences on implicit measures should show higher levels of temporal stability than individual differences on explicit measures. Counter to this prediction, we found that individual differences on implicit measures showed significantly lower levels of temporal stability than individual differences on explicit measures. This finding replicated with two frequently used implicit measures (i.e., AMP, IAT) in three content domains (i.e., self-concept, racial attitudes, political attitudes) with time intervals of 1 to 2 months. Across the two studies, explicit measures showed a weighted average stability of $r = .75$ (i.e., shared variance of 56% between the two measurement points), whereas implicit measures showed a weighted average stability of $r = .54$ (i.e., shared variance of 29% between the two measurement points). This difference emerged despite comparable estimates of internal consistency, suggesting that measurement error does not account for the obtained differences in temporal stability. Together, these findings stand in contrast to the claim that implicit measures reflect early experiences, whereas explicit measures reflect recent experiences (e.g., Petty et al., 2006; Rudman, 2004; Wilson et al., 2000). If anything, our findings indicate that responses on implicit measures are less anchored in the past than responses on explicit measures.

Resistance to Change and Stability Over Time

By comparing the temporal stability of individual differences on implicit and explicit measures, our findings expand on earlier evidence showing that implicit measures can be more or less resistant to situationally induced changes than explicit measures. This conclusion is consistent with the disparate body of experimental research showing (a) changes on explicit, but not implicit, measures; (b) changes on implicit, but not explicit, measures; and (c) changes on both explicit and implicit measures (for a review, see Gawronski & Bodenhausen, 2006). However, evidence for experimental effects on a given measure does not necessarily question a

Table 2. Summary of Studies That Include Data on the Temporal Stability of Implicit Measures With Time Delays of at Least One Day.

Reference	Study	Measure	Topic	Time interval	*n*	*r*
Bosson, Swann, and Pennebaker (2000)	1	Implicit Association Test	Self-esteem	22-38 days	79	.69
Bosson et al. (2000)	1	Supraliminal Evaluative Priming	Self-esteem	22-38 days	81	.08
Bosson et al. (2000)	1	Subliminal Evaluative Priming	Self-esteem	22-38 days	81	.28
Chan, Chen, Hibbert, Wong, and Miller (2011)	1	Affect Misattribution Procedure	Family attitudes—anger	1-6 months	85	.49[a]
Chan et al. (2011)	1	Affect Misattribution Procedure	Family attitudes—fear	1-6 months	85	.57[a]
Chan et al. (2011)	1	Affect Misattribution Procedure	Family attitudes—warmth	1-6 months	85	.50[b]
Cunningham, Preacher, and Banaji (2001)	1	Implicit Association Test	Racial attitudes	2-8 weeks	93	.31[b]
Cunningham et al. (2001)	1	Response Window Implicit Association Test	Racial attitudes	2-8 weeks	93	.24[b]
Cunningham et al. (2001)	1	Response Window Evaluative Priming	Racial attitudes	2-8 weeks	93	.25[b]
Dasgupta and Greenwald (2001)	1	Implicit Association Test	Racial attitudes	1 day	48	.65
Egloff and Schmukle (2002)	1	Implicit Association Test	Anxiety self-concept	8 days	41	.57
Devine, Forscher, Austin, and Cox (2012)	1	Implicit Association Test	Racial attitudes	4 weeks	38	.33
Devine et al. (2012)	1	Implicit Association Test	Racial attitudes	8 weeks	38	.21
Devine et al. (2012)	1	Implicit Association Test	Racial attitudes	4 weeks	38	.18
Devine et al. (2012)	1	Implicit Association Test	Racial attitudes	4 weeks	53	.36
Devine et al. (2012)	1	Implicit Association Test	Racial attitudes	8 weeks	53	.01
Devine et al. (2012)	1	Implicit Association Test	Racial attitudes	4 weeks	53	.27
Egloff, Schwerdtfeger, and Schmukle (2005)	1	Implicit Association Test	Anxiety self-concept	1 week	65	.58
Egloff et al. (2005)	2	Implicit Association Test	Anxiety self-concept	1 month	39	.62
Egloff et al. (2005)	3	Implicit Association Test	Anxiety self-concept	1 year	36	.47
Galdi, Arcuri, and Gawronski (2008)	1	Single-Category Implicit Association Test	Political attitudes	1 week	129	.48
Galdi, Gawronski, Arcuri, and Friese (2012)	1	Single-Category Implicit Association Test	Political attitudes	1 week	113	.37
Gschwendner, Hofmann, and Schmitt (2008)	1	Implicit Association Test	Anxiety self-concept	2 weeks	53	.67
Gschwendner et al. (2008)	1	Implicit Association Test	Anxiety self-concept	2 weeks	52	.63
Gschwendner et al. (2008)	1	Implicit Association Test	Anxiety self-concept	2 weeks	50	.45
Gschwendner et al. (2008)	2	Implicit Association Test	Racial attitudes	2 weeks	32	.72
Gschwendner et al. (2008)	2	Implicit Association Test	Racial attitudes	2 weeks	31	.29
Hu et al. (2015)	1	Implicit Association Test	Gender stereotypes	1 week	38	.29
Hu et al. (2015)	1	Implicit Association Test	Racial attitudes	1 week	38	.34
Steffens and Buchner (2003)	1	Implicit Association Test	Attitudes toward gay men	1 week	84	.50

[a]The study included a total of three sessions that were 1 month and 5 months apart, respectively. The reported correlation is the average test–retest correlation of all measurements.
[b]The study included a total of four sessions that were 2 weeks apart, respectively. The reported correlation is the average test–retest correlation of all measurements.

persistent impact of early experiences, because such effects may reflect situationally induced shifts that are still anchored in early experiences. Thus, despite the available evidence for experimentally induced changes on implicit measures, it is possible that responses on implicit measures are shaped by early experiences over and above the obtained effects of recent experiences. Counter to this hypothesis, the current findings indicate that individual differences in implicit measures show lower levels of temporal stability than individual differences on explicit measures. Thus, in addition to being sensitive to recent experiences, responses on implicit measures seem to be less anchored in the past than responses on explicit measures.

Our findings also shed new light on previous findings suggesting that racial attitudes tend to be highly stable on both implicit and explicit measures. Such a conclusion might be drawn from data reported by Schmidt and Nosek (2010), who found that mean scores of racial attitudes barely changed

during Barack Obama's presidential campaign and his early presidency. Yet, as we noted in the introduction, these findings do not speak to the actual stability of racial attitudes over time, because equivalent mean scores at the sample level may conceal fluctuations at the level of individual differences. Stringent tests of such fluctuations require longitudinal designs with multiple data points from the same participants and stability analyses of rank orders rather than mean values. Although racial attitudes on explicit measures were relatively stable in the current studies (weighted average stability of $r = .72$), racial attitudes on implicit measures showed considerable fluctuation at the level of individual differences (weighted average stability of $r = .41$). Importantly, this pattern emerged despite stable mean values on both implicit measures at the sample level. These findings point to the importance of distinguishing between mean values and rank orders in longitudinal analyses, in that equivalent sample means over time provide little information about the temporal stability of individual differences.

Implications

How can the obtained asymmetry at the measurement level be explained at the mental level (cf. De Houwer, Gawronski, & Barnes-Holmes, 2013)? Drawing on the core assumptions of the APE model, a potential explanation is that implicit measures are highly sensitive to fluctuations in the momentary activation of associations in memory (Gawronski & Bodenhausen, 2006, 2011). Because the activation of associations in response to a target object can be shaped by contextual cues and other situational factors (for a review, see Gawronski & Sritharan, 2010), implicit measures may show low levels of temporal stability when changes in the broader context activate different associations at different measurement times (see Gschwendner, Hofmann, & Schmitt, 2008; Rydell & Gawronski, 2009). In contrast, explicit measures may capture the outcome of propositional validation processes, in that they reflect what a person believes to be true or false (Gawronski & Bodenhausen, 2006, 2011). Although activated associations are an important determinant of such beliefs (Peters & Gawronski, 2011), the informational input for propositional inferences is often much more complex. As a result, activated associations are sometimes rejected as a basis for overt judgments when they are inconsistent with other relevant information (e.g., Gawronski et al., 2008; Gawronski & Strack, 2004). To the extent that the outcome of such validation processes is more consistent over time and across contexts compared with the momentary activation of associations, explicit measures may show higher levels of temporal stability than implicit measures (for a detailed discussion, see Gawronski & Bodenhausen, 2007). For example, after reading an article about potential positive effects of capital punishment, an opponent of the death penalty may show enhanced activation of favorable associations regarding capital punishment on an implicit measure. However, such changes in the activation of associations may not necessarily lead to corresponding changes in overtly expressed opinions on an explicit measure, which may be supported by a much more complex set of propositional information (e.g., Arendt, 2013; Dasgupta & Greenwald, 2001). Thus, although exposure to incidental cues may cause fluctuations in the activation of associations over time, these fluctuations may be compensated by consistent outcomes of propositional validation processes. As a result, implicit measures may show lower stability over time than explicit measures, which is consistent with the findings of the current research.[14]

The current findings also have important implications for the predictive validity of implicit measures (see Perugini, Richetin, & Zogmaister, 2010). If there is a delay between the administration of the implicit measure and the measurement of the to-be-predicted behavior, the predictive validity of implicit measures may be reduced due to the low temporal stability of implicit measures. Importantly, this may be the case even when the constructs captured by implicit measures are more proximal determinants of the to-be-predicted behavior than corresponding explicit measures. Thus, from a purely pragmatic perspective, explicit measures may often be superior if the goal is to predict future behavior over longer periods of time, simply because they show less temporal fluctuation than implicit measures. Yet, if the goal is to understand the mental underpinnings of behavior (e.g., Galdi et al., 2008; Galdi et al., 2012), the differential stability of implicit and explicit measures needs to be taken into account when testing hypotheses about their relations to overt behavior.

Limitations

Although the reported findings are consistent across the two studies, it is important to note a few limitations that require further research. First, our conclusions are based on data with two implicit measures, raising the question of whether they generalize to other implicit measures. Our choice was based on the concern that many implicit measures have shown rather low internal consistencies (Gawronski & De Houwer, 2014), which can attenuate longitudinal correlations due to random measurement error. To avoid potential distortions of our findings, we deliberately chose two measures that have shown internal consistencies that meet the psychometric standards for explicit measures. Each of these measures showed lower levels of temporal stability than explicit measures, despite comparable estimates of internal consistency. A similar pattern emerged in our review of earlier studies with longitudinal designs, and some of these studies used measures that were different from the ones included in the current research (see Table 2). Nevertheless, future research using other implicit measures would help to provide further evidence for the generality of our findings.

Another caveat is that our studies focused on three selected topics (i.e., self-concept, racial attitudes, political

attitudes), raising the question of whether implicit measures might show higher levels of temporal stability in other domains. Although it seems plausible that the temporal stability of implicit measures might vary as a function of the measured construct, this does not imply that the obtained difference between explicit and implicit measures is attenuated or reversed for other constructs. This conclusion is consistent with our review of published studies, showing even larger differences at the aggregate level. Nevertheless, future research comparing the longitudinal stability of implicit and explicit measures in other domains would help to shed further light on this question.

Conclusion

Resonating with similar claims in psychoanalytic theory, the field of implicit social cognition has been inspired by the idea that traces of past experiences may linger in the unconscious even when people revised their conscious beliefs in response to recent experiences (Greenwald & Banaji, 1995). This idea has served as the basis for the hypothesis that implicit measures reflect early experiences, whereas explicit measures reflect recent experiences (e.g., Rudman, 2004; Wilson et al., 2000). Expanding on previous research showing that implicit measures can be more or less resistant to situationally induced changes than explicit measures (for a review, see Gawronski & Bodenhausen, 2006), we reported the results of two longitudinal studies showing that individual differences on implicit measures are less stable over time than individual differences on explicit measures. Thus, counter to the common assumption that implicit measures reflect early experiences, our findings suggest that implicit measures are less anchored in the past than explicit measures.

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Supplemental Material

The supplemental material is available with the online version of the article.

Notes

1. Based on an anticipated attrition rate of 50% and a desired final sample of at least 100 participants, we aimed to recruit 200 participants in the first session. Due to decreasing sign-up rates over the course of the recruitment phase and the limited period dedicated for the first session, we fell short of our target for the first session by six participants.
2. The internal consistency of the Implicit Association Test (IAT) was estimated by creating two IAT scores on the basis of the first and second halves of the two combined blocks and calculating a Cronbach's α value for the two scores.
3. For all studies reported in this article, tests of differences between correlations obtained from the same sample were conducted with the statistical online tool at http://www.quantitativeskills.com/sisa/statistics/correl.htm.
4. Attrition analyses revealed no significant differences in any of the Time 1 measures for participants who did versus did not return for the second session (all ts < 1.13, all ps > .26).
5. The internal consistency of the Affect Misattribution Procedure (AMP) was estimated by creating two AMP scores on the basis of the first and second half of the task and calculating a Cronbach's α value for the two scores.
6. Attrition analyses revealed that preferences for Whites over Blacks on the feeling thermometer tended to be somewhat higher for participants who returned for the second session than for participants who did not return for the second session, $t(191) = 1.71$, $p = .09$, $d = 0.308$. There were no significant differences between participants who did versus did not return for the second session in any of the other Time 1 measures (all ts < 0.58, all ps > .56).
7. Because there are different explanations for high temporal stability of individual differences (e.g., stable traits vs. stable environments), the expression "anchored in the past" is meant to be purely descriptive (rather than explanatory), in that a person's rank order position on a given measure at Time 1 provides meaningful information about that person's rank order position on the same measure at Time 2.
8. Similar to our first study, we aimed to recruit up to 200 participants during the predetermined recruitment phase of the first session. Due to decreasing sign-up rates toward the end of the recruitment phase and the limited period dedicated for the first session, we fell short of our target for the first session by 36 participants.
9. The internal consistency of the AMP was estimated by dividing the trials into three consecutive parts of equal length and calculating Cronbach's α values for each of the three aggregate scores (i.e., scores of relative preference for Clinton over Trump, priming scores for Clinton, priming scores for Trump). Deviating from the use of two test-halves in Study 1b, we used three parts of equal length in the current study to obtain an equal number of test items for the implicit and the explicit measure.
10. Attrition analyses revealed that participants who returned for the second session showed more favorable evaluations of Clinton on the explicit measure than participants who did not return for the second session, $t(161) = 2.79$, $p = .006$, $d = 0.489$. There were no significant differences between participants who did versus did not return for the second session for any of the other Time 1 measures (all ts < 1.33, all ps > .18).
11. Cronbach's α scores for the IAT were calculated in line with the procedures of Study 1a. Following recommendations by

Greenwald, Nosek, and Banaji (2003), we used the first 20 trials of the two combined blocks to calculate one IAT score and the remaining 40 trials to calculate a second IAT score.

12. Attrition analyses revealed no significant differences between participants who did versus did not return for the second session in any of the Time 1 measures (all ts < 1.01, all ps > .31).
13. A potential reason for the lower stability of implicit measures in previous studies is that some of them included implicit measures with low internal consistencies (cf. Gawronski & De Houwer, 2014).
14. One reviewer suggested that the temporal stability of explicit measures may be inflated when participants remember their earlier response and try to be consistent in their responses over time. Although such memory-based processes may account for differences in the temporal stability of implicit and explicit measures in studies using relatively short intervals (see Table 2), we doubt that participants' memory for their earlier responses was sufficiently strong in the current studies, which used intervals of 1 to 2 months.

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