Relationship between the Implicit Association Test and explicit measures of intergroup cognition:
Data from the meta-analysis by Kurdi et al. (2018)

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All data files and analysis scripts used in this project are available for download from the Open Science Framework (<https://osf.io/k7qx5/>).

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In our recent meta-analysis (Kurdi et al., 2018), we reported detailed investigations of the relationship between Implicit Association Tests (IATs; Greenwald, McGhee, & Schwartz, 1998) measuring attitudes (e.g., White/Asian–good/bad), stereotypes (e.g., White/Asian–dumb/smart), and identity (e.g., White/Asian–me/not me) and a wide range of criterion measures of intergroup behavior. Although this was not a requirement for inclusion in the meta-analytic database, in addition to implicit and criterion measures, some studies also reported explicit (self-report) measures of attitudes, stereotypes, and identity.

To the extent that explicit measures were used in the relevant studies, the dataset forming the basis of the meta-analysis conducted by Kurdi et al. (2018) and made publicly available on the Open Science Framework (OSF; <https://osf.io/k7qx5/>) contains information on implicit–explicit correlations (IECs) as well as their moderator variables. With the exception of analyses concerning incremental predictive validity, data on IECs were not analyzed by Kurdi et al. (2018). Unlike in other investigations (Cameron, Brown-Iannuzzi, & Payne, 2012; Hofmann, Gawronski, Gschwendner, Le, & Schmitt, 2005; Nosek, 2005), the implicit–explicit relationship was not of primary concern to our recent meta-analysis; however, researchers interested in this relationship may still gain valuable insights from the data generated there.

As such, the present report includes a meta-analytic measure of effect size, followed by the results of moderator analyses. Similar to the analyses reported by Kurdi et al. (2018), all analyses reported here were conducted using correlated effects models (Hedges, Tipton, & Johnson, 2010), which explicitly account for statistical dependencies among effect sizes extracted from the same study. Analyses were implemented using the *robumeta* package (Fisher & Tipton, 2015) in the R

statistical computing environment. The raw data and R code are freely available for download from OSF (<https://osf.io/k7qx5/>).

Meta-analytic effect size

The meta-analytic effect size was estimated using an intercept-only correlated effects model (Hedges et al., 2010) relying on 710 effect sizes extracted from 160 research reports with a combined sample size of 10,218. The meta-analytic average of implicit–explicit correlations (IECs) significantly differed from zero and was small in size, $r = .12$ [.09; .14], $t(159) = 8.97$, $p < .001$. The 90-percent prediction interval (Borenstein, Higgins, Hedges, & Rothstein, 2017) around the mean effect size ranged from $r_{\min} = -.12$ to $r_{\max} = .33$, indicating that 90 percent of IECs in the intergroup domain are expected to fall in the small negative to medium-sized positive range. This result corresponds to a high level of heterogeneity and, as such, we report detailed analyses of the moderators of the implicit–explicit relationship below.

Moderator variables

The results of moderator analyses involving six groups of moderator variables (basic study characteristics, conceptual variables, study-level methodological variables, measure-level methodological variables, sample characteristics, and publication-related variables) are reported in Table 1, with brief interpretations provided below.

Basic study characteristics

The first group of moderators reported by Kurdi et al. (2018) concerned basic characteristics of the studies, including study setting, target group, and type of behavior. Conceptually, type of behavior is independent of the implicit–explicit relationship; as such, here we report analyses involving only study setting and target group. Paralleling the results on implicit–criterion correlations (ICCs), we found that study setting (real-world, online, or lab) did not significantly moderate im-

PLICIT–EXPLICIT CORRELATIONS (IECs). By contrast and in deviation from the results obtained with ICCs as the dependent variable, target group category emerged as a significant moderator: IECs were highest for studies involving sexual orientation, with all other target group categories producing significantly smaller effects.

Conceptual variables

Similar to the results obtained with ICCs as the dependent measure, attribute concept (attitude, stereotype, or identity) did not significantly moderate the implicit–explicit relationship. The variables involving social sensitivity yielded conflicting results: Whereas the regular versions of these variables produced significant effects, their blind-coded counterparts did not. Specifically, the regular implicit and explicit social sensitivity variables both positively predicted the size of the implicit–explicit correlation. This result is in conflict with the prevailing theoretical view according to which implicit–explicit correlations should be especially high when social desirability concerns are absent (Nosek, 2005). However, it should be noted that the effect size for both variables was small, with only a difference of $r_{\text{diff}} = .09$ predicted between the lowest and highest possible values of social sensitivity. Moreover, the same result was not replicated using the blind-coded versions of the same variables, thus raising the possibility that awareness of the study outcomes may have contaminated coding of the social sensitivity variable.

Study-level methodological variables

Study-level methodological variables (including whether studies focused on the implicit–explicit relationship, whether studies used a manipulation, and what kind of manipulation they used) did not moderate the implicit–explicit relationship. However, it should be noted that the study-level methodological variables were not primarily designed with the implicit–explicit rela-

tionship in mind. A different set of study-level methodological variables specifically conceived to address the implicit–explicit relationship may very well have impact.

Measure-level methodological variables

Most measure-level methodological variables investigated also did not emerge as significant moderators of the implicit–explicit relationship. Notably, (*a*) the order in which implicit and explicit measures were administered within a study (implicit first, explicit first, or counterbalanced), (*b*) attribute polarity (i.e., the extent to which the IAT attributes were polar opposites of each other; e.g., smart/dumb vs. smart/weak), and (*c*) target polarity (i.e., the extent to which the IAT attributes were polar opposites of each other; e.g., White/Black vs. elderly/Asian) produced no effect. The only variable that significantly moderated the implicit–explicit relationship was implicit scoring method, with the D algorithm (Greenwald, Nosek, & Banaji, 2003) producing a higher average IEC than the scoring algorithm originally introduced by Greenwald et al. (1998). This result should not be surprising given that one of the criteria used to evaluate the D algorithm was that the scores produced should maximize correlation with explicit measures.

Sample characteristics

Some characteristics of the samples used significantly moderated the magnitude of the implicit–explicit relationship. Specifically, online and real-world samples produced larger effects than general samples, student samples, and samples preselected on some kind of measure (e.g., scores on a depression scale). Moreover, the data suggest that implicit–explicit correlations may be lower in American samples than in samples from outside the United States; however, this result did not reach conventional levels of statistical significance. Within the same group of variables, type of student sample (pre-college vs. college) and sample composition (stigmatized, nonstigmatized, or mixed) did not produce significant effects.

Publication-related variables

Finally, several publication-related variables significantly moderated the implicit–explicit relationship. Specifically, (*a*) journal impact factor, (*b*) mean IAT experience (measured as mean number of reports included in the meta-analytic database for the authors of the given report), (*c*) first author IAT experience (measured as number of reports included in the meta-analytic database for the first author of the given report), (*d*) maximum and (*e*) mean network centrality of the authors of the report in a collaboration network emerging from all reports included in the meta-analytic database, and (*f*) IAT originator status each positively predicted the magnitude of the implicit–explicit correlation. By contrast, year of publication, publication status (published vs. unpublished), and yearly citation count had no impact. Moreover, IAT experience and network centrality measured for the last author of each report also did not produce a significant effect.

Summary

In the present report we provide a brief summary of the relationship between implicit and explicit measures of social cognition based on the meta-analytic database analyzed in more detail with respect to the relationship between measures of social cognition and measures of intergroup behavior by Kurdi et al. (2018). In the present analysis, a statistically significant but small relationship emerged between implicit and parallel explicit measures of attitudes, stereotypes, and identity.

The implicit–explicit relationship was characterized by high levels of statistical heterogeneity, thus making moderator analyses necessary. Implicit and explicit measures were more highly correlated with each other in studies (*a*) of sexual orientation (relative to other target group categories), (*b*) using the improved scoring algorithm (Greenwald et al., 2003) to index IAT performance, (*c*) conducted using real-world or online samples (relative to general, student, and preselected samples),

(*d*) conducted using foreign samples (relative to U.S. samples), and (*e*) conducted by authors with higher levels of experience involving the Implicit Association Test.

Other variables that, based on theoretical or practical considerations, may have been expected to produce an effect had no impact. Notably, (*a*) study setting (real-world, online, or lab), (*b*) attribute concept (attitude, stereotype, or identity), (*c*) social sensitivity, (*d*) order of implicit and explicit measures (implicit first, explicit first, or counterbalanced), and (*e*) publication status of the report (published vs. unpublished) had no significant effect.

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Table 1. Summary table of univariate meta-regressions predicting implicit–explicit correlations (IECs) on the basis of moderator variables. Mean = mean of moderator variable, SD = standard deviation of moderator variable, k_{total} = total number of effect sizes included in the model, k_{ind} = number of independent effect sizes included in the model, b = unstandardized regression coefficient, CI lower = lower bound of the 95-percent confidence interval, CI upper = upper bound of the 95-percent confidence interval, DF = degrees of freedom, t = value of the t statistic, p = p value, τ^2 = residual heterogeneity, [B] = blind-coded version of moderator variable. For categorical predictors (with their levels listed), b coefficients represent condition means, whereas for metric predictors, b coefficients represent units of change in the dependent variable (IEC) associated with one unit of change in the moderator variable. For categorical moderators, asterisks in the superscript indicate a significant difference from the first (reference) category at $p < .10$, $p < .05$, and $p < .01$, respectively.

Moderator	Mean	SD	k_{total}	k_{ind}	b	CI lower	CI upper	DF	t	p	τ^2
<i>(1) Basic study characteristics</i>											
Study setting											
Real-world	–	–	68	16	0.180	0.055	0.300	15	3.06	.008	.049
Online	–	–	154	25	0.139	0.075	0.202	24	4.46	< .001	.026
Lab	–	–	488	119	0.101	0.074	0.127	118	7.53	< .001	.015
Target group category											
Sexuality	–	–	24	8	0.218	0.150	0.285	7	7.39	< .001	.003
Race**	–	–	281	64	0.134	0.088	0.180	63	5.71	< .001	.030
Ethnicity*	–	–	78	19	0.129	0.086	0.172	18	6.27	< .001	.001
Other intergroup***	–	–	55	13	0.093	0.028	0.157	12	3.11	.009	.004
Gender***	–	–	165	27	0.087	0.030	0.144	26	3.11	.005	.019
Other clinical***	–	–	42	14	0.056	-0.038	0.149	13	1.29	.218	.019
Eating disorder***	–	–	65	17	0.053	-0.010	0.115	16	1.78	.093	.006
<i>(2) Conceptual variables</i>											
Concept											
Attitude	–	–	420	123	0.118	0.087	0.149	122	7.40	< .001	.025
Stereotype	–	–	232	45	0.101	0.064	0.138	44	5.46	< .001	.011
Identity	–	–	58	12	0.087	-0.005	0.177	11	2.08	.061	.024
Implicit social sensitivity	5.342	1.567	710	160	0.014	0.000	0.028	158	1.98	.049	.020
Implicit social sensitivity [B]	4.553	1.707	710	160	0.014	-0.001	0.028	158	1.86	.064	.020
Explicit social sensitivity	5.261	1.621	710	160	0.016	0.001	0.031	158	2.18	.031	.021
Explicit social sensitivity [B]	4.985	1.518	710	160	0.003	-0.015	0.020	158	0.30	.761	.021

Moderator	Mean	SD	k_{total}	k_{ind}	b	CI lower	CI upper	DF	t	p	τ^2
<i>(3) Methodological variables: Study-level</i>											
Study focus											
Primary without moderator	–	–	261	79	0.136	0.099	0.173	78	7.22	< .001	.019
Secondary without moderator	–	–	28	10	0.107	-0.027	0.237	9	1.81	.104	.024
Primary with moderator	–	–	161	34	0.102	0.051	0.151	33	4.09	< .001	.019
Secondary with moderator	–	–	22	6	0.088	-0.043	0.216	5	1.73	.145	.005
Incidental	–	–	238	31	0.082	0.025	0.139	30	2.92	.007	.039
Manipulation											
No	–	–	375	89	0.120	0.086	0.153	88	6.96	< .001	.023
Yes	–	–	335	72	0.107	0.071	0.143	71	5.89	< .001	.011
Type of manipulation											
Within subjects	–	–	57	27	0.145	0.062	0.226	26	3.58	.001	.017
Mixed	–	–	72	9	0.138	0.094	0.182	8	7.09	< .001	.001
Between subjects	–	–	203	35	0.074	0.037	0.111	34	4.05	< .001	.005
<i>(4) Methodological variables: Measure-level</i>											
Type of implicit measure											
IRAP	–	–	8	4	0.128	-0.052	0.300	3	2.26	.109	.056
IAT	–	–	567	138	0.115	0.088	0.143	137	8.21	< .001	.021
IAT variant	–	–	135	22	0.112	0.046	0.177	21	3.53	.002	.035
Order of implicit and explicit measures											
Random	–	–	177	35	0.152	0.105	0.198	34	6.48	< .001	.024
Explicit first	–	–	187	52	0.113	0.063	0.163	51	4.52	< .001	.021
Implicit first	–	–	346	73	0.097	0.059	0.134	72	5.11	< .001	.016
Implicit scoring method											
D score	–	–	452	111	0.132	0.101	0.163	110	8.33	< .001	.019
Other	–	–	74	21	0.077	0.015	0.139	20	2.59	< .001	.013
1998 scoring**	–	–	146	29	0.063	0.013	0.113	28	2.57	< .001	.013

Moderator	Mean	<i>SD</i>	k_{total}	k_{ind}	b	CI lower	CI upper	DF	t	p	τ^2
Explicit scoring method											
Difference score	–	–	193	49	0.142	0.096	0.188	48	6.10	< .001	.028
Relative rating*	–	–	109	22	0.119	0.056	0.181	21	3.93	.001	.017
Single rating	–	–	399	109	0.110	0.079	0.142	108	6.91	< .001	.020
Target polarity	2.546	0.732	688	155	0.003	-0.015	0.020	153	1.39	.168	.021
Attribute polarity	2.687	0.533	688	155	0.029	-0.008	0.066	153	1.57	.119	.021
<i>(5) Sample characteristics</i>											
Stigmatized sample											
Only stigmatized	–	–	188	41	0.144	0.082	0.204	40	4.69	< .001	.030
Mixed	–	–	130	35	0.112	0.054	0.169	34	3.91	< .001	.026
Nonstigmatized	–	–	388	106	0.103	0.074	0.132	105	6.93	< .001	.016
Special sample											
Online	–	–	72	11	0.180	0.056	0.298	10	3.23	.009	.036
Real-world	–	–	135	38	0.153	0.088	0.217	37	4.71	< .001	.028
General**	–	–	31	12	0.092	0.028	0.155	11	3.16	.009	.000
Student**	–	–	429	96	0.091	0.063	0.119	95	6.33	< .001	.012
Preselected**	–	–	39	8	0.070	-0.034	0.173	7	1.59	.156	.018
Student sample											
Undergrad & grad	–	–	440	106	0.089	0.061	0.116	105	6.37	< .001	.013
Pre-college	–	–	55	7	0.088	0.016	0.159	6	2.98	.025	.000
Sample country											
Foreign	–	–	316	59	0.150	0.114	0.185	58	8.34	< .001	.019
U.S.*	–	–	394	104	0.099	0.065	0.132	103	5.85	< .001	.021
<i>(6) Publication-related variables</i>											
Year	2010.366	2.503	710	160	0.004	-0.005	0.014	158	0.97	.333	.021
Publication status											
Published	–	–	644	144	0.120	0.093	0.147	143	8.72	< .001	.021
Unpublished	–	–	66	16	0.075	0.002	0.147	15	2.18	.045	.021
Impact factor	2.598	2.567	581	133	0.004	0.000	0.008	131	2.00	.048	.021
Yearly citation count	6.491	6.534	710	160	0.002	-0.000	0.005	158	1.66	.098	.020
IAT experience (mean)	2.127	1.358	710	160	0.023	0.000	0.045	158	2.01	.047	.019
IAT experience (first)	1.987	1.243	710	160	0.022	0.001	0.009	158	3.41	.001	.019

Moderator	Mean	<i>SD</i>	k_{total}	k_{ind}	b	CI lower	CI upper	DF	t	p	τ^2
IAT experience (last)	2.580	2.627	710	160	0.004	-0.012	0.020	158	0.46	.644	.020
Authorship centrality (max)	433.486	905.559	710	160	0.000	0.000	0.000	158	2.98	.003	.018
Authorship centrality (mean)	156.024	352.151	710	160	0.000	0.000	0.000	158	2.04	.043	.019
Authorship centrality (last)	341.691	814.484	710	160	0.000	-0.000	0.000	158	0.85	.400	.020
IAT originators											
Yes	–	–	118	15	0.210	0.113	0.303	14	4.60	< .001	.034
No ^{**}	–	–	589	146	0.102	0.077	0.127	145	7.96	< .001	.015