Empirical Research Paper

Implicit Transgender Attitudes Independently Predict Beliefs About Gender and Transgender People

Personality and Social Psychology Bulletin
1-18

DOI: 10.1177/0146167220921065
journals.sagepub.com/home/pspb
SAGE

Jordan R. Axt[1,2], Morgan A. Conway[3], Erin C. Westgate[4], and Nicholas R. Buttrick[5]

Abstract

Surprisingly little is known about transgender attitudes, partly due to a need for improved measures of beliefs about transgender people. Four studies introduce a novel Implicit Association Test (IAT) assessing implicit attitudes toward transgender people. Study 1 ($N = 294$) found significant implicit and explicit preferences for cisgender over transgender people, both of which correlated with transphobia and transgender-related policy support. Study 2 ($N = 1{,}094$) found that implicit transgender attitudes predicted similar outcomes among participants reporting no explicit preference for cisgender versus transgender people. Across Study 3a ($N = 5{,}647$) and Study 3b ($N = 2{,}276$), implicit transgender attitudes predicted multiple outcomes, including gender essentialism, contact with transgender people, and support for transgender-related policies, over and above explicit attitudes. This work introduces a reliable means of measuring implicit transgender attitudes and illustrates how these attitudes independently predict meaningful beliefs and experiences.

Keywords

implicit attitudes, IAT, explicit attitudes, transgender, transphobia, policy

Received October 6, 2019; revision accepted March 27, 2020

On January 9, 2019, a transgender woman (i.e., whose gender identity differed from that assigned at birth) was assaulted in a North Carolina bathroom by two cisgender women (i.e., whose gender identity matched that assigned at birth). This altercation followed the 2017 repeal of North Carolina H.B.2 (the "bathroom bill" requiring people to use restrooms matching gender assigned at birth), and its replacement by one preventing cities from enacting laws protecting transgender people (Brice-Saddler, 2019). Roughly half of 1% of the American adult population identifies as transgender, and between 2% and 5% experience gender dysphoria (a disconnection between gender identity and identity assigned at birth; Gates, 2011; Van Kesteren et al., 1996). Although people increasingly report knowing a transgender person (Halloran, 2015), transgender people continue to be victims of discrimination, including efforts to restrict public bathroom access (Associated Press, 2017) and ban military service (Diamond, 2017).

Do people's personal feelings, both implicit and explicit, about transgender people relate to how likely they are to support policies related to the treatment of transgender people, such as "bathroom bans"? In the present work, we develop and validate a measure of implicit transgender attitudes, and explore how implicit transgender attitudes predict support for such policies and other transgender-related beliefs.

Explicit Attitudes Toward Transgender People

Self-reported attitudes are known to influence policy support in many domains (e.g., Lax & Phillips, 2009), but relatively little is known about self-reported attitudes toward transgender people. In one nationally representative sample, Americans' attitudes toward transgender people were less warm than attitudes toward lesbian or gay people (Norton & Herek,

[1] McGill University, Montreal, Québec, Canada
[2] Project Implicit, Seattle, WA, USA
[3] Walter Reed Army Institute of Research, Silver Spring, MD, USA
[4] University of Florida, Gainesville, USA
[5] University of Virginia, Charlottesville, USA

Corresponding Author:
Jordan R. Axt, McGill University, 2001 McGill College Avenue, Montreal, Québec, Canada H3A 0G4.
Email: jordan.axt@gmail.com

2013). Negative attitudes toward transgender people are particularly pronounced among political conservatives (Norton & Herek, 2013), more religious people (Kanamori et al., 2017; Nagoshi et al., 2008), older people (Landén & Innala, 2000), and heterosexuals (Willoughby et al., 2010). Moreover, feelings of disgust toward transgender bodies predict opposition to transgender rights policies (Miller et al., 2017).

Self-reported transgender attitudes are strongly related (but not identical) to people's attitudes toward lesbian and gay people (Nagoshi et al., 2008; Norton & Herek, 2013; Willoughby et al., 2010). People who have greater personal contact with sexual minorities (e.g., lesbian, gay, and bisexual people) report more positive attitudes toward transgender people (Flores, 2015; Norton & Herek, 2013). Evidence for a similar effect for transgender contact is more mixed. Personal contact with transgender people has been associated with increased positivity in most, but not all, prior studies (King et al., 2009; Tompkins et al., 2015; Willoughby et al., 2010; cf. Flores, 2015).

Explicit attitudes about transgender people are also, unsurprisingly, related to broader beliefs about gender. Endorsement of the gender "binary," or the belief that only two genders exist, is associated with more negative attitudes toward transgender people (Norton & Herek, 2013), whereas people who believe in a biological basis for transgender identity tend to report more positive attitudes (Landén & Innala, 2000).

The Role of Implicit Transgender Attitudes

With only one exception, prior work on transgender-related beliefs has examined their association with *explicit* transgender attitudes (i.e., attitudes consciously experienced and recognized as one's own; Greenwald & Banaji, 1995). However, these outcomes may also be related to *implicit* transgender attitudes (i.e., automatically activated associations; Gawronski & Bodenhausen, 2007). Prior research has shown that implicit and explicit attitudes represent distinct but related constructs (e.g., Nosek & Smyth, 2007), as implicit and explicit intergroup attitudes can diverge (Jost et al., 2004), change at varying rates (Charlesworth & Banaji, 2019), and differentially correlate with behavior (Kurdi et al., 2019; cf. Oswald et al., 2013).

A growing area of research has begun documenting implicit and explicit gender attitudes of both cisgender and transgender people. For example, a study of transgender children (Olson et al., 2015) found more positive implicit gender attitudes toward a child's expressed gender than toward their gender assigned at birth; similar results emerged when using a measure of implicit gender identity (Gülgöz et al., 2019). This work reveals how both explicit and implicit gender cognition corresponds with experiences of gender transitions, but the development of implicit measures of transgender attitudes is noticeably lacking compared with corresponding explicit measures.

In fact, the only existing measure of implicit transgender attitudes (Wang-Jones et al., 2017, 2018) used an Implicit Association Test (IAT; Greenwald et al., 1998), and found that implicit attitudes toward "transsexual men" and "transsexual women" correlate reliably but weakly with parallel explicit attitudes. However, this implicit measure had features that limit its generalizability. Wang-Jones et al. (2018) measured attitudes not toward "transgender people," but toward "transsexual men" (vs. "biological men") and "transsexual women" (vs. "biological women"). Because category labels strongly influence implicit attitude measurement (Govan & Williams, 2004), comparing associations toward "transgender people" (vs. "cisgender people") likely captures different attitudes than those toward "transsexual men" (vs. "biological men") and "transsexual women" (vs. "biological women"). These latter labels base category membership on the status of a person's genitals (rather than gender) and invoke derogatory stereotypes. In addition, this prior measure assesses attitudes toward transgender men and women separately rather than toward transgender people as a whole. Previous intergroup research has shown that attitudes toward subgroups can be very different than attitudes towards the larger group (i.e., Black people and Black women; Fiske et al., 2002; Sesko & Biernat, 2010). Although considering intersectionality and the differential experiences of transgender men versus women is important (Worthen, 2013), it is also critical to understand evaluations of transgender people more globally.

Moreover, there is currently limited evidence that implicit transgender attitudes predict transgender-related beliefs after controlling for explicit attitudes. Such evidence would suggest that implicit attitudes play an independent role in individuals' beliefs about transgender people, with potentially unique causes driving their development. Most prior investigations into this issue of incremental predictive validity for implicit attitudes (including Wang-Jones et al., 2017) relied on least squares linear regression, an analysis strategy known to inflate false positives (Westfall & Yarkoni, 2016) due to inability to account for measurement reliability. Establishing the incremental predictive validity of transgender attitudes via more appropriate analysis strategies would provide evidence for the predictive validity of both implicit transgender attitudes and implicit association measures in general.

The Current Work

We sought to develop the first measure of implicit attitudes toward transgender people as a single category, and determine whether implicit transgender attitudes predict important beliefs and behavior above and beyond explicit attitudes. We developed two versions of an IAT, with stimuli consisting of either images or text. Across four studies, we find robust evidence for antitransgender implicit attitudes, and that such attitudes—particularly when measured using images of prominent cisgender and transgender people—are

associated with a variety of beliefs and behaviors concerning transgender people and gender more broadly.

Drawing from prior efforts to validate IATs and other measures, we used a number of criteria to compare whether the image-based or text-based IAT was a superior measure of implicit transgender attitudes. We focus on four criteria for evaluating the two IATs: predictive and convergent validity, mean-level effects, known-groups differences, and internal reliability. Below, we briefly review the logic behind each as a means of evaluating a measure's validity.

Predictive and Convergent Validity

A better measure of a construct should correlate more strongly with related measures due to reduced measurement error. Just as the correlation between height and weight—two distinct but related constructs—is weakened when error is introduced into measurement, more precise measures of implicit attitudes should maximize associations with related self-report measures. This reasoning holds for tests of convergent validity, which involves measures that are at the same conceptual level (e.g., implicit and explicit measures of attitudes toward transgender people), as well as predictive validity, which involves measures of related concepts (e.g., transgender attitudes and support for transgender-related policies).

Prior work finds self-reported attitudes toward transgender people are correlated with outcomes such as support for the gender "binary" (Norton & Herek, 2013), and prior contact with transgender people (King et al., 2009). Because past studies have shown consistent correlations between implicit and explicit attitudes across domains (Nosek, 2005), implicit transgender attitudes should be correlated with these and other self-reported outcomes related to transgender people (e.g., policy support, transphobia), particularly given robust evidence that IATs in general are associated with such outcomes (Kurdi et al., 2019). Measures that best reduce random error will strengthen these correlations, so IATs that produce stronger correlations with related outcomes should be considered better measures of the construct. See Axt (2018) for parallel reasoning when evaluating measures of explicit racial attitudes.

Mean-Level Effects

A better measure of a construct should be more sensitive to the assessed construct. As prior work finds general antitransgender attitudes in self-report (Norton & Herek, 2013), it is reasonable to expect antitransgender attitudes in measures of implicit attitudes, especially given implicit intergroup attitudes generally exhibit stronger levels of favoritism than explicit intergroup attitudes (e.g., Nosek, 2005). Similar reasoning has been used as a criterion for evaluating IATs related to gender and age attitudes (Greenwald et al., 2003), and assumes that the modal response tendency (i.e., preferences for cisgender over transgender people) reflects population differences in association strength. That is, because the general population on average shows preferences for cisgender over transgender people, noise in measurement will only weaken the capacity to detect this preference. Mean-level effects (e.g., overall preferences for White vs. Black people) have also been used to compare the relative validity of several measures of implicit attitudes assumed to assess the same construct (e.g., implicit racial attitudes; Bar-Anan & Nosek, 2014). The same reasoning applies here; if two measures are designed to tap into the construct of implicit transgender attitudes, the one that produces larger average levels of antitransgender attitudes should be superior.

Known-Groups Differences

A better measure of a construct should reliably vary between groups known to differ on that construct. There are known differences between groups in explicit transgender attitudes, specifically that (a) cisgender people report more negative transgender attitudes than transgender people and (b) straight people report more negative transgender attitudes than gay or lesbian people (Willoughby et al., 2010). Again, it is reasonable to assume these differences also exist in implicit attitudes, particularly given past work finding robust intergroup differences in domains such as race (e.g., Nosek et al., 2007) and sexuality (e.g., Jost et al., 2004).

The observed magnitude of the difference between groups is underestimated when there is noise in measurement. As a result, measures that minimize measurement error will maximize the differences in attitudes between transgender versus cisgender participants, as well as straight versus gay or lesbian participants, though this analysis assumes that measurement error is not confounded with gender identity or sexual orientation (Nosek et al., 2014). Given this assumption, measures that show larger group differences will thus be considered superior measures. A similar approach of comparing strength of known-groups differences has been used when evaluating measures of explicit racial attitudes (Axt, 2018), measures of implicit political attitudes (Bar-Anan & Nosek, 2014), or scoring algorithms for a single implicit measure (Nosek et al., 2014).

Internal Reliability

Greater internal reliability does not guarantee superior measurement of a construct, but all else equal, measures with greater internal reliability reduce measurement error. IATs with greater internal reliability would then be superior measures of the construct, provided that the IAT also fares comparably well in the above criteria (see Sriram & Greenwald, 2009, for a similar approach in evaluating implicit attitudes about consumer preferences).

Study 1

Study 1 compared two IATs measuring implicit evaluations of transgender versus cisgender people. The first IAT used images of cisgender and transgender celebrities. There are potential drawbacks to using celebrity images as stimuli. For instance, if people are unfamiliar with the celebrities, it may lead to difficulty in categorization, marked by weak internal reliability. Therefore, Study 1 compared the celebrity image-based transgender IAT with a text-based IAT using words related to transgender and cisgender people.

Method

Participants

Three hundred six volunteers at Project Implicit (https://implicit.harvard.edu) completed both IATs. We sought a sample that would provide more than 80% power for detecting a small within-subjects effect of $d = 0.20$. Participants completed demographics as part of registration ($M_{age} = 38.7$ years, $SD = 14.2$ years; 71.6% White; 55.2% female; 59.8% U.S. citizens). Degrees of freedom vary due to missing data. Data, materials, and analysis syntax for all studies are available at https://osf.io/rcgdx/.

Measures

Implicit transgender attitudes. Implicit attitudes were measured using a seven-block IAT. Each participant completed two IATs: an image version and a text-only version. In both versions, attributes were good words ("Nice," "Pleasure," "Laughter," "Glorious") or bad words ("Nasty," "Agony," "Hurt," "Rotten"). Both IATs used category labels of "Transgender people" and "Cisgender people" (see Online Supplement for table detailing block structure).

Stimuli in the image IAT consisted of eight celebrities (four cisgender, four transgender) matched on race, approximate age, and popularity (estimated from Google search returns). To increase familiarity with the stimuli, participants were shown brief descriptions of each and completed a 24-trial training block sorting the images (labeled as cisgender or transgender) into cisgender or transgender categories. See Online Appendix A for stimuli and descriptions.

Stimuli in the text-based IAT consisted of words related to cisgender people ("Cisgender people," "Cisgender," "Cismen," "Ciswomen") and transgender people ("Transgender people," "Transmen," "Transwomen," "Trans"), and did not include a training block. IATs followed the design recommended in Nosek et al. (2007) and were scored by the *D* algorithm (Greenwald et al., 2003), such that more positive scores indicated more positive associations with cisgender versus transgender people. Data from nine participants were excluded from analyses due to having more than 10% of trials faster than 300 ms on either IAT (Nosek et al., 2007).

Explicit transgender attitudes. Participants reported their preference between cisgender and transgender people ($-3 = I$ *strongly prefer transgender to cisgender people*, $+3 = I$ *strongly prefer cisgender to transgender people*). Warmth toward transgender and cisgender people separately was measured using two thermometer items (1 = *very cold*, 7 = *very warm*).

Support for policies affecting transgender people. Participants reported agreement with five transgender-related policies (1 = *strongly disagree*, 7 = *strongly agree*): bathroom use, adoption rights, insurance coverage for transgender care, ability to dress in a manner matching expressed gender, and obtaining new identification. Higher scores indicated greater agreement with policies allowing more freedom to transgender people ($\alpha = .87$; see Online Appendix B).

Self-reported transphobia. The nine-item Transphobia Scale (Nagoshi et al., 2008) includes items such as "I think there is something wrong with a person who says that they are neither a man nor a woman" (1 = *strongly disagree*, 7 = *strongly agree*). Higher scores indicated greater transphobia ($\alpha = .86$).

Procedure

Participants completed the IATs in randomized order, followed by the self-report measures in randomized order.

Results

We compared the IATs on internal reliability and *D* scores. We computed Cronbach's alpha (Cronbach, 1955) for each IAT by matching the 60 critical trials in Blocks 3 and 4 with the 60 critical trials in Blocks 6 and 7, then dividing these trials into three parcels of 20 trials (first 20 trials of Blocks 3 and 4 and first 20 trials of Blocks 6 and 7 into the first parcel, etc.) and computing *D* scores for each parcel.

Both IATs exhibited acceptable internal reliability. The image IAT ($\alpha = .72$) was slightly more reliable than the text-based IAT ($\alpha = .70$), but a Feldt (1969) test found the measures did not reliably differ, $W = 0.95$, $p = .337$.

Both IATs found more positive implicit associations for cisgender versus transgender people on average (image: $t(305) = 13.57$, $p < .001$, $d = 0.78$; text: $t(305) = 6.86$, $p < .001$, $d = 0.39$). However, the image IAT ($M = 0.31$, $SD = 0.39$) produced larger effects than the text IAT ($M = 0.17$, $SD = 0.42$), $t(305) = 5.26$, $p < .001$, $d = 0.30$, 95% confidence interval (CI) = [0.19, 0.42].

Finally, both IATs reliably correlated with each other ($r = .33$, $p = .001$), as well as self-reported warmth toward transgender people, relative preferences between cisgender

Table 1. Descriptive Statistics and Correlations Among Study 1 Measures ($N = 260$).

Measure	Mean	*SD*	1	2	3	4	5	6	7
1. Image IAT *D* score	0.31	0.39	—	[0.22, 0.44]	[−0.09, 0.16]	[−0.27, −0.03]	[0.13, 0.35]	[−0.39, −0.17]	[0.15, 0.38]
2. Text IAT *D* score	0.17	0.42	.33	—	[−0.07, 0.17]	[−0.28, −0.05]	[0.12, 0.35]	[−0.27, −0.03]	[0.11, 0.34]
3. Warmth for cisgender	5.27	1.34	^{ns} .04	^{ns} .05	—	[0.21, 0.43]	[0.17, 0.39]	[−0.14, 0.10]	[−0.03, 0.21]
4. Warmth for transgender	4.88	1.40	−.15	−.17	.32	—	[−0.57, −0.39]	[0.41, 0.59]	[−0.68, −0.53]
5. Relative preference	4.58	1.03	.24	.24	.29	−.49	—	[−0.57, −0.39]	[0.49, 0.65]
6. Policy advocacy	5.84	1.36	−.29	−.16	^{ns} −.02	.51	−.48	—	[−0.76, −0.58]
7. Self-reported transphobia	2.89	1.27	.27	.22	^{ns} .09	−.61	.57	−.68	—

Note. ^{ns} denotes a correlation where $p > .05$. All other correlations significant at $p < .05$. IAT = Implicit Association Test.

and transgender people, transphobia, and support for transgender-related policies (all$|r|$s > .15, all ps < .014, see Table 1 for correlation matrix and descriptive statistics). There were no reliable differences between the IATs in correlations with warmth toward transgender people ($t(292) = -0.23$, $p = .818$), warmth toward cisgender people ($t(288) = -0.27$, $p = .789$), explicit preferences between transgender and cisgender people ($t(289) = 0.31$, $p = .975$) or transphobia ($t(276) = 0.56$, $p = .573$). The image IAT was marginally more correlated with support for transgender policies than the text IAT, $t(278) = 1.91$, $p = .057$.

Discussion

Two IATs assessing implicit transgender attitudes showed more negative associations with transgender versus cisgender people. Each measure correlated with explicit attitudes toward transgender people and beliefs about their treatment. The IATs reliably correlated with each other, providing evidence of convergent validity. However, the degree to which the two measures correlated with each other ($r = .33$) was lower than the test–retest value observed in a recent IAT meta-analysis ($r = .50$; Greenwald & Lai, 2020). Follow-up research will need to clarify the degree to which this discrepancy is a result of methodological differences between the two tasks (e.g., different stimuli) versus the topic of transgender versus cisgender attitudes (e.g., transgender attitudes may be lower in elaboration; Nosek, 2007).

The IATs had comparable internal reliability, but the image-based IAT produced greater mean-level biases against transgender people and was a slightly better predictor of support for transgender policies. This is suggestive evidence that the image-based IAT is a superior measure of implicit transgender attitudes, but Studies 2 and 3a use both IATs to provide further tests of comparative validity.

In Study 2, we sought to provide a stronger test of the predictive validity of implicit transgender attitudes by investigating whether each IAT predicted transphobia and support for policies concerning transgender people in a sample with no self-reported preference between cisgender and transgender people. If the IAT is simply an alternative way of measuring the same attitudes people report explicitly, then it should not predict outcomes in a sample reporting no explicit preferences. In contrast, if implicit transgender attitudes predict outcomes even among participants reporting no explicit preferences, it would provide further evidence that implicit transgender attitudes are distinct from explicit attitudes. We applied the same evaluation criteria used in Study 1, as these criteria apply equally when measuring implicit attitudes among a sample of participants who report no explicit preferences for or against transgender people.

Study 2

Method

Participants. Participants were volunteers at Project Implicit. Participants were first asked for their relative explicit preference for cisgender versus transgender people. Only those reporting no preference for transgender versus cisgender people (58.2%) were eligible to continue. In total, 1,117 participants ($M_{age} = 34.95$ years, $SD = 14.0$ years; 68.5% White; 68.8% female; 65.7% U.S. citizens) provided usable IAT data, which for each IAT provided more than 95% power for detecting a correlation as small as $r = .15$. Nineteen participants were removed from analyses using the same criteria as Study 1.

Measures. Participants completed the same IATs, self-reported transphobia ($\alpha = .84$) and policy support ($\alpha = .85$) as Study 1. Participants also separately reported how much they liked or disliked transgender and cisgender people (1 = *strongly dislike*, 7 = *strongly like*). Participants were randomly assigned to complete the image- or text-based IAT.

Procedure. Following the explicit preference screening item, participants completed the IAT and then all other measures in a randomized order.

Results

As in Study 1, both IATs found more positive implicit associations for cisgender versus transgender people, with the image IAT ($M = 0.20$, $SD = 0.42$) producing larger effects

Table 2. Descriptive Statistics and Correlations Among Measured Variables in Study 2.

Measure	Mean	*SD*	1	2	3	4	5	6
1. Image IAT *D* score	0.20	0.42	—	—	[−0.13, 0.05]	[−0.29, −0.13]	[−0.24, −0.07]	[0.18, 0.34]
2. Text IAT *D* score	0.12	0.41	—	—	[−0.04, 0.13]	[−0.12, 0.05]	[−0.15, 0.02]	[0.01, 0.18]
3. Liking for cisgender	5.15	1.28	−.04 ^{ns}	.05 ^{ns}	—	[0.68, 0.74]	[0.13, 0.24]	[−0.21, −0.09]
4. Liking for transgender	5.19	1.30	−.21	−.04 ^{ns}	.71	—	[0.26, 0.37]	[−0.42, −0.31]
5. Policy advocacy	6.06	1.19	−.15	−.06 ^{ns}	.18	.31	—	[−0.59, −0.51]
6. Self-reported transphobia	2.50	1.06	.26	.09	−.15	−.37	−.44	—

Note. ^{ns} denotes a correlation where $p > .05$. All other correlations significant at $p < .05$. IAT = Implicit Association Test.

than the text IAT ($M = 0.12$, $SD = 0.41$), $t(1,092) = 3.41$, $p < .001$, $d = 0.21$, 95% CI = [0.09, 0.32].

The image IAT ($\alpha = .76$) was also more reliable than the text IAT ($\alpha = .66$), $W = 0.71$, $p < .001$. Both IATs reliably correlated with self-reported transphobia, though only the image IAT correlated with liking of transgender people and policy support (see Table 2 for correlation matrix and descriptive statistics), and neither IAT correlated with liking of cisgender people. The image IAT had a stronger correlation with transphobia (Fisher's $Z = 2.82$, $p = .005$) and liking of transgender people (Fisher's $Z = 2.94$, $p = .003$) than the text IAT, but not with policy support (Fisher's $Z = 1.47$, $p = .142$) or liking of cisgender people (Fisher's $Z = -1.45$, $p = .147$).

Discussion

Even in a sample reporting no explicit preferences for cisgender versus transgender people, we found evidence for significant *implicit* preferences for cisgender over transgender people. These implicit attitudes predicted self-reported transphobia and support for transgender-related policies for the image (though not the text) IAT. Results suggest that implicit transgender attitudes may play a unique role in understanding beliefs about transgender people.

Study 2 found further evidence for the superior validity of the image IAT, as seen in greater internal reliability, larger *D* scores indicating procisgender implicit attitudes, and stronger correlations with self-reported transphobia and liking of transgender people.

We build on this work in Study 3a by including both IATs, a wider range of self-report measures, and tests of known-groups differences. In addition, we sought statistically robust evidence that implicit transgender attitudes predict such outcomes beyond explicit transgender attitudes by relying on structural equation modeling analyses that account for measurement reliability (Westfall & Yarkoni, 2016). We also included tests of model fit to investigate whether implicit and explicit transgender attitudes are best conceived as a single construct, two independent constructs, or two distinct but related constructs (Nosek & Smyth, 2007). Finally, Study 3a included a sample of transgender participants.

Study 3a

Method

Participants. Five thousand six hundred forty-seven Project Implicit volunteers ($M_{age} = 31.5$ years, $SD = 13.0$ years; 72.3% White; 60.1% female; 72.3% U.S. citizens) provided eligible IAT data for the study, which was the "featured task" on the site's front page. We collected data until there were at least 30 transgender participants with usable IAT data for each IAT and at least 450 participants completing each outcome measure to facilitate structural equation modeling (SEM) analyses (Kline, 2005). Due to delays in study replacement, the final sample was slightly larger, providing at least 80% power for detecting a correlation as small as $r = .13$.

Measures and procedure. Participants completed the following measures in randomized order.

Implicit transgender attitudes. Participants completed either the image or text IAT. For SEM analyses, the implicit construct was estimated by four indicators, created by dividing each IAT block into four bins and calculating *D* scores for each. Participants were excluded from analyses using the same criteria as Study 1 (2.7% of IAT scores).

Explicit transgender attitudes. Participants completed the relative explicit preference item and thermometer items from Study 1. Participants also completed the two liking items of transgender and cisgender people from Study 2. The explicit construct was estimated by three (standardized) indicators: the explicit preference item, a difference score between thermometer items, and a difference score between liking items ($\alpha = .87$). Difference scores were calculated such that more positive scores indicated more warmth or liking of cisgender people. For least squares linear regression and correlational analyses, we calculated an explicit attitude variable by averaging the three standardized variables.[1]

Demographics. Participants completed a 14-item demographics questionnaire, including sexual orientation, gender identity, age, race, ethnicity, and country of citizenship (all variables available in the online data set). One item assessed sexual orientation; participants reported whether they

identified as heterosexual or straight (73.8%), lesbian or gay (6.3%), bisexual (11.8%), queer (5.0%), or belonging to another sexual orientation (3.1%).

Two items assessed gender: Participants first reported sex assigned at birth (male or female), followed by current gender identity (male, female, trans male/trans man, trans female/trans woman, genderqueer/gender nonconforming, a different identity). Participants could select multiple categories. Participants were categorized as cisgender (86.8%) if sex assigned at birth matched current gender identity. Participants were categorized as transgender (1.6%) if they either (a) reported their gender identity as "trans male/trans man" or "trans female/trans woman" (and did not report their gender identity as "genderqueer" or "a different identity") or (b) reported their gender identity as male or female, and this differed from the sex assigned at birth.

Outcome measures. Participants were randomly assigned to complete two of eight measures (see Online Appendix C for wording and scoring information):

1. *Support for four transgender-related policies* (16 items; adapted from Roberts et al., 2017): transgender people serving in the military, transgender bathroom bans, university-provided counseling services for transgender people, and banning "trans panic" as a legal defense. Responses were averaged (α = .92); higher values indicate more agreement with policies supportive of transgender people.
2. *Past experience or willingness to have a romantic relationship* with a transgender person (five items; α = .89). Higher values indicated greater willingness or experience.
3. *Previous or current contact with transgender people* (four items; α = .64);[2] higher values indicated more contact.
4. *Misconceptions about transgender people* (20 items; α = .93; sample items: "Transgender people are confused about their sexuality," "Transgender people are trying to trick others"); higher values indicate greater endorsement of misconceptions.
5. *Transgender Attitudes and Belief Scale* (TABS; Kanamori et al., 2017; 29 items, α = .95; sample item: "A person does not have to be clearly male or female to be normal and healthy"); higher values indicate more positive attitudes/beliefs about transgender people.
6. *Gender essentialism* (Hettinger, 2014; five items, α = .77, sample item: "Masculinity and femininity are mutually exclusive categories, and each person either belongs to one or the other"); higher scores indicate greater essentialism.
7. *Ambivalent Sexism Inventory* (Glick & Fiske, 1996; 22 items): Hostile Sexism (α = .91) and Benevolent Sexism (α = .84) subscales. Higher scores indicate greater sexism.

An additional measure of familiarity with the image IAT stimuli is available in the online data set but was not included in primary analyses.

Results

Internal Reliability

Again, the image IAT had a higher internal reliability (α = .80) than the text-based IAT (α = .70), $W = 0.68$, $p < .001$.

Ingroup Favoritism Among Transgender and Cisgender Participants

Among cisgender participants, the image IAT ($M = 0.20$, $SD = 0.45$) produced stronger antitransgender attitudes than the text IAT ($M = 0.12$, $SD = 0.41$), $t(5{,}035) = 6.79$, $p < .001$, $d = 0.19$, 95% CI = [0.14, 0.25].

Both IATs also showed ingroup favoritism among transgender participants (image $N = 41$, $M = -0.20$, $SD = 0.49$, $t(40) = 2.63$, $p = .012$, $d = 0.41$; text $N = 47$, $M = -0.33$, $SD = 0.38$, $t(46) = -5.92$, $p < .001$, $d = 0.86$), though the two IATs did not reliably differ in strength of ingroup favoritism, $t(86) = 1.38$, $p = .170$, $d = 0.30$, 95% CI = [−0.13, 0.72].

Known-Groups Differences in Transgender Attitudes

On the relative preference item, cisgender ($M = 0.57$, $SD = 1.05$) and transgender participants ($M = -0.79$, $SD = 1.29$) both demonstrated explicit ingroup favoritism (all ts > 5.75, all ps < .001, all ds > .59; see Online Supplement for individual tests), which reliably differed between groups, $t(4{,}888) = 11.86$, $p < .001$, $d = 1.16$. This finding mirrors prior research (Willoughby et al., 2010).

For implicit attitudes, IAT version did not moderate relative differences between cisgender and transgender participants. A 2 (IAT type) by 2 (gender identity) analysis of variance (ANOVA) found a reliable main effect of gender identity, $F(1, 5{,}121) = 83.88$, $p < .001$, $\eta_p^2 = .016$, and a reliable main effect of IAT version, $F(1, 5{,}121) = 5.12$, $p = .024$, $\eta_p^2 = .001$, but no interaction between IAT type and gender identity, $F(1, 5{,}121) = 0.24$, $p = .627$, $\eta_p^2 < .001$. That is, the image IAT ($d = 0.86$) and text-based IAT ($d = 1.13$) did not reliably differ in ability to detect differences in implicit attitudes between transgender and cisgender participants.

For explicit attitudes among gay and straight participants, straight participants preferred cisgender over transgender people ($d = 0.62$), whereas gay participants showed no reliable preference ($d = 0.08$, see Online Supplement for individual tests). These attitudes reliably differed, $t(4{,}125) = 9.94$, $p < .001$, $d = .60$, again replicating prior work (Willoughby et al., 2010).

Table 3. Descriptive Statistics and Correlations (*r*) With IAT *D* Scores.

Measure	Mean	*SD*	Correlation with image IAT *D*	Correlation with text IAT *D*	Fisher's *Z*
1. Explicit attitudes (range = −3.6–3.4)	−0.01	0.88	.36 [0.33, 0.40]	.35 [0.32, 0.38]	0.63, $p = .529$
2. Policy support (range = 1–7)	5.61	1.20	−.30 [−0.38, −0.22]	−.31 [−0.39, −0.23]	−0.16, $p = .873$
3. Relationship interest (range = 0–5)	1.74	1.89	−.37 [−0.44, −0.29]	−.27 [−0.34, −0.19]	1.80, $p = .072$
4. Transgender contact (range = 0–4)	1.67	1.18	−.31 [−0.38, −0.23]	−.20 [−0.28, −0.12]	1.93, $p = .054$
5. Attitude and Belief Scale (range = 1–5)	4.36	0.72	−.36 [−0.43, −0.28]	−.33 [−0.40, −0.25]	0.48, $p = .631$
6. Transgender misconceptions (range = 1–7)	2.03	0.98	.30 [0.22, 0.37]	.24 [0.16, 0.31]	1.07, $p = .285$
7. Gender essentialism (range = 1–7)	2.96	1.32	.28 [0.20, 0.35]	.13 [0.05, 0.20]	2.65, $p = .008$
8. Benevolent sexism (range = 1–6)	2.69	0.96	.27 [0.19, 0.35]	.13 [0.04, 0.21]	2.34, $p = .019$
9. Hostile sexism (range = 1–6)	2.36	1.08	.31 [0.23, 0.39]	.15 [0.07, 0.23]	2.74, $p = .006$

Note. All correlations significant at $p < .003$. IAT = Implicit Association Test.

Table 4. Coefficients and Test Statistics for Linear Regression Analyses in Study 3a.

Outcome	Image IAT β	*t*	*p*	Text IAT β	*t*	*p*
1. Policy support	−0.09	−2.51	.013	−0.07	−1.84	.067
2. Relationship interest	−0.21	−5.36	<.001	−0.12	−3.02	.003
3. Transgender contact	−0.20	−5.17	<.001	−0.08	−1.86	.065
4. Attitude and Belief Scale	−0.10	−2.88	.004	−0.09	−2.52	.012
5. Transgender misconceptions	0.09	2.26	.024	0.02	0.49	.628
6. Gender essentialism	0.09	2.26	.024	−0.04	−0.96	.339
7. Benevolent sexism	0.18	4.18	<.001	−0.01	−0.12	.903
8. Hostile sexism	0.16	4.01	<.001	−0.03	−0.61	.540

Note. IAT = Implicit Association Test.

For implicit attitudes, IAT type significantly moderated the relative difference between gay and straight participants in implicit transgender attitudes. A 2 (IAT version) by 2 (sexual orientation) ANOVA revealed a main effect of sexual orientation, $F(1, 4{,}330) = 80.60$, $p < .001$, $\eta_p^2 = .018$, no main effect of IAT version, $F(1, 4{,}330) = 1.38$, $p = .239$, $\eta_p^2 < .001$, and a sexual orientation by IAT version interaction, $F(1, 4{,}330) = 13.45$, $p < .001$, $\eta_p^2 = .003$. The image IAT produced a larger difference between gay and straight participants in implicit attitudes ($d = 0.66$) than the text IAT ($d = 0.31$). See Table 3 for descriptive statistics of Study 3a measures.

Correlations Between Transgender Attitudes and Outcome Measures

IAT *D* scores and the explicit preference variable reliably correlated with all outcome measures in the expected direction (all$|r|$s > .12, all *p*s < .003). See Table 4 for correlations between each IAT and self-report measure, and Fisher's *Z* tests comparing the strength of the correlation between IATs. The image IAT was more strongly correlated with three of the nine self-report outcome variables than the text IAT, and the text IAT failed to have a stronger correlation with any outcome.

Incremental Predictive Validity of the Transgender IAT

We first tested for incremental predictive validity using traditional least squares linear regression, predicting each outcome from participants' IAT *D* score and aggregate explicit attitude variable (see Table 4). Using this approach, stronger implicit and explicit preferences for cisgender over transgender should be associated with lower policy support, less relationship interest, less contact, more misconceptions, less positive beliefs and attitudes toward transgender people, greater gender essentialism, and increased hostile and benevolent sexism. In all analyses, explicit transgender attitudes were reliably associated with the outcome measure (all$|\beta|$s > 0.29, all *t*s > 6.62, all *p*s < .001, see Online Supplement). In comparison, the image IAT reliably predicted all and the text IAT reliably predicted two of the eight outcomes, using a strict $p < .05$ cutoff.

These linear regressions are helpful in drawing comparisons with prior work, but this analysis strategy can increase false positives for claims of incremental predictive validity by not accounting for measurement (un)reliability (Westfall & Yarkoni, 2016). As a result, we also tested for incremental predictive validity using an analysis strategy that accounts for measurement reliability: structural equation modeling.

For each outcome and IAT, we fit a set of nested structural equation models, in which a latent implicit attitude factor and a latent explicit attitude factor predicted the manifest outcome variable. Each latent variable was identified by fixing the path to its first element at 1, and the implicit and explicit latent factors were allowed to freely

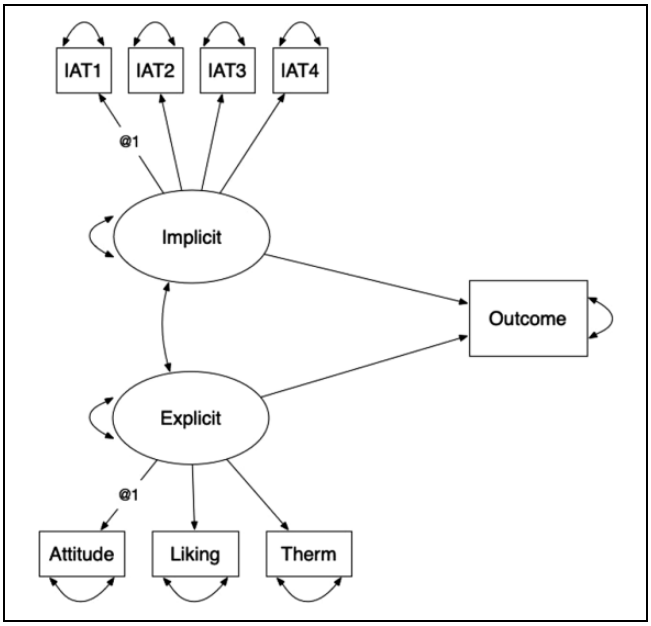

Figure 1. Schematic path diagram for the structural equation models assessing incremental predictive validity in Study 3a. *Note.* Means for all manifest variables were estimated (not shown here).

covary. See Figure 1 for a schematic path diagram. Evidence of incremental predictive validity was present if removing the direct path between the implicit latent variable and the outcome measure significantly reduced model fit.

In the image IAT, we found evidence for incremental predictive validity of the implicit construct for five of eight outcomes, compared with one of eight outcomes for the text IAT.

All significant SEM path coefficients were in the same direction as the regression analyses. See Table 5 for model output.

Tests of Construct Independence

The consistent incremental predictive validity of the IAT, particularly the image IAT, is suggestive evidence that these measures assess different types of attitudes than the explicit attitude items—but this assumption can also be tested directly. To assess whether implicit and explicit transgender attitudes are separable constructs, we examined the relationship between the implicit and explicit latent factors (e.g., Nosek & Smyth, 2007) separately for each IAT.

We fit three nested structural equation models (see Figure 2 for path diagrams), and found that a model allowing implicit and explicit transgender attitudes to be distinct but related constructs fit the data better than a model that fixed them to one unitary construct (image IAT: $\chi^2(1) = 2{,}866.85$, $p < .001$; text IAT: $\chi^2(1) = 2{,}297.80$, $p < .001$), or a model that fixed them to be two separate constructs (image IAT: $\chi^2(1) = 348.26$, $p < .001$; text IAT: $\chi^2(1) = 326.44$, $p < .001$). See Table 6 for model fit statistics.

Discussion

Cisgender and transgender participants showed ingroup favoritism in implicit transgender attitudes. SEM analyses of the image IAT revealed incremental predictive validity for five of the eight outcome measures, meaning the image IAT explained variance in outcomes such as relationship interest beyond that explained by the measure of explicit attitudes. The image IAT had higher internal reliability and produced stronger mean-level effects among cisgender participants. The image IAT was also more strongly correlated with a number of related outcomes, such as hostile sexism and gender essentialism.

To provide better estimates of the incremental predictive validity of the image IAT, we ran an additional study using the same outcome measures and meta-analyzed the results of Studies 3a and 3b.

Study 3b

Method

Participants. Two thousand one hundred eighty-five Project Implicit volunteers ($M_{age} = 32.4$ years, $SD = 13.0$ years; 72.7% White; 60.4% female; 69.6% U.S. citizens) provided eligible IAT data. The study was again the site's "featured task." The final sample provided more than 99% power for detecting the smallest correlation between implicit transgender attitudes and any outcome measure found in Study 3a.

Measures and procedure. Participants completed the same measures as Study 3a using the same procedure, with the only change being all participants completed the image IAT. For sexual orientation, 72.7% of the sample identified as heterosexual or straight, 8.7% as lesbian or gay, 9.6% as bisexual, 5.4% as queer, and 3.6% as having another sexual orientation. For gender, 88.6% of the sample was classified as cisgender, and 2.7% as transgender.

Results

Comparing Cisgender and Transgender Participants

Results replicated findings of Study 3a. Transgender ($N = 60$) and cisgender ($N = 1{,}918$) participants showed ingroup favoritism in implicit and explicit attitudes (all ts > 3.28, all ps < .003, all ds > 0.41; see Online Supplement for individual tests).

Table 5. Coefficients and Test Statistics for SEM Analyses in Study 3a.

Outcome	AIC	CFI	TLI	RMSEA	Explicit β	Implicit β	Model Δ−2LL	Comparison *P*
1. Policy support								
Image IAT								
Full model	16,434.00	0.995	0.992	0.029	−0.89 [−1.02, −0.76]	−0.28 [−0.57, 0.02]	—	—
Explicit-only model	16,435.38	0.995	0.992	0.029	−0.95 [−1.06, −0.83]	—	3.38	.066
Text IAT								
Full model	17,196.01	0.995	0.992	0.027	−0.89 [−1.01, −0.77]	−0.18 [−0.45, 0.10]	—	—
Explicit-only model	17,195.58	0.995	0.992	0.027	−0.93 [−1.03, −0.83]	—	1.57	.210
2. Relationship interest								
Image IAT								
Full model	16,947.77	0.994	0.991	0.031	−1.01 [−1.21, −0.82]	−1.06 [−1.52, −0.60]	—	—
Explicit-only model	16,965.85	0.992	0.988	0.035	−1.22 [−1.40, −1.04]	—	20.07	<.001***
Text IAT								
Full model	17,854.64	0.995	0.992	0.027	−1.00 [−1.19, −0.81]	−0.54 [−0.99, −0.09]	—	—
Explicit-only model	17,858.18	0.994	0.992	0.028	−1.10 [−1.27, −0.94]	—	5.55	.019*
3. Transgender contact								
Image IAT								
Full model	16,648.49	0.994	0.991	0.032	−0.42 [−0.54, −0.31]	−0.68 [−0.97, −0.40]	—	—
Explicit-only model	16,668.87	0.991	0.987	0.037	−0.55 [−0.66, −0.44]	—	22.38	<.001***
Text IAT								
Full model	17,429.33	0.997	0.995	0.022	−0.54 [−0.66, −0.43]	−0.20 [−0.51, 0.11]	—	—
Explicit-only model	17,428.91	0.997	0.995	0.022	−0.58 [−0.69, −0.48]	—	1.58	.209
4. Attitude and Belief Scale								
Image IAT								
Full model	15,846.60	0.993	0.989	0.035	−0.58 [−0.65, −0.51]	−0.19 [−0.36, −0.02]	—	—
Explicit-only model	15,849.61	0.993	0.989	0.035	−0.61 [−0.68, −0.56]	—	5.01	.025*
Text IAT								
Full model	16,557.07	0.994	0.990	0.031	−0.64 [−0.70, −0.57]	−0.06 [−0.22, 0.09]	—	—
Explicit-only model	16,555.74	0.994	0.991	0.030	−0.65 [−0.71, −0.59]	—	0.67	.414
5. Transgender misconceptions								
Image IAT								
Full model	16,296.90	0.995	0.992	0.029	0.75 [0.63, 0.88]	0.09 [−0.15, 0.33]	—	—
Explicit-only model	16,295.41	0.995	0.993	0.028	0.78 [0.67, 0.88]	—	0.51	.476
Text IAT								
Full model	16,997.31	0.997	0.995	0.022	0.82 [0.73, 0.91]	−0.07 [−0.29, 0.15]	—	—
Explicit-only model	16,995.67	0.997	0.995	0.021	0.81 [0.73, 0.89]	—	0.36	.549
6. Gender essentialism								
Image IAT								
Full model	16,664.31	0.994	0.991	0.032	0.74 [0.61, 0.87]	0.29 [−0.03, 0.61]	—	—
Explicit-only model	16,665.57	0.994	0.991	0.032	0.80 [0.69, 0.92]	—	3.25	.071
Text IAT								
Full model	17,503.86	0.995	0.992	0.027	0.85 [0.72, 0.98]	−0.21 [−0.52, 0.10]	—	—
Explicit-only model	17,503.67	0.995	0.992	0.027	0.82 [0.70, 0.93]	—	1.80	.179
7. Benevolent sexism								
Image IAT								
Full model	16,363.94	0.995	0.992	0.030	0.30 [0.20, 0.41]	0.52 [0.25, 0.79]	—	—
Explicit-only model	16,376.07	0.993	0.990	0.033	0.39 [0.30, 0.49]	—	14.13	<.001***
Text IAT								
Full model	17,176.96	0.995	0.992	0.027	0.41 [0.29, 0.52]	0.02 [−0.25, 0.30]	—	—
Explicit-only model	17,174.99	0.995	0.993	0.026	0.41 [0.31, 0.51]	—	0.03	.868
8. Hostile sexism								
Image IAT								
Full model	16,392.42	0.995	0.993	0.028	0.59 [0.49, 0.70]	0.50 [0.22, 0.77]	—	—
Explicit-only model	16,403.10	0.994	0.991	0.031	0.68 [0.58, 0.77]	—	12.69	<.001***
Text IAT								
Full model	17,246.60	0.996	0.994	0.024	0.62 [0.50, 0.74]	−0.08 [−0.37, 0.21]	—	—
Explicit-only model	17,244.89	0.996	0.994	0.023	0.60 [0.50, 0.71]	—	0.29	.590

Note. All values based on tests with 1 *df*. Values in brackets are 95% confidence intervals. SEM = structural equation modeling; AIC = Akaike information criterion; CFI = comparative fit index; TLI = Tucker–Lewis index; RMSEA = root mean square error of approximation; −2LL = −2 log likelihood; IAT = Implicit Association Test.
*$p < .05$. ***$p < .001$.

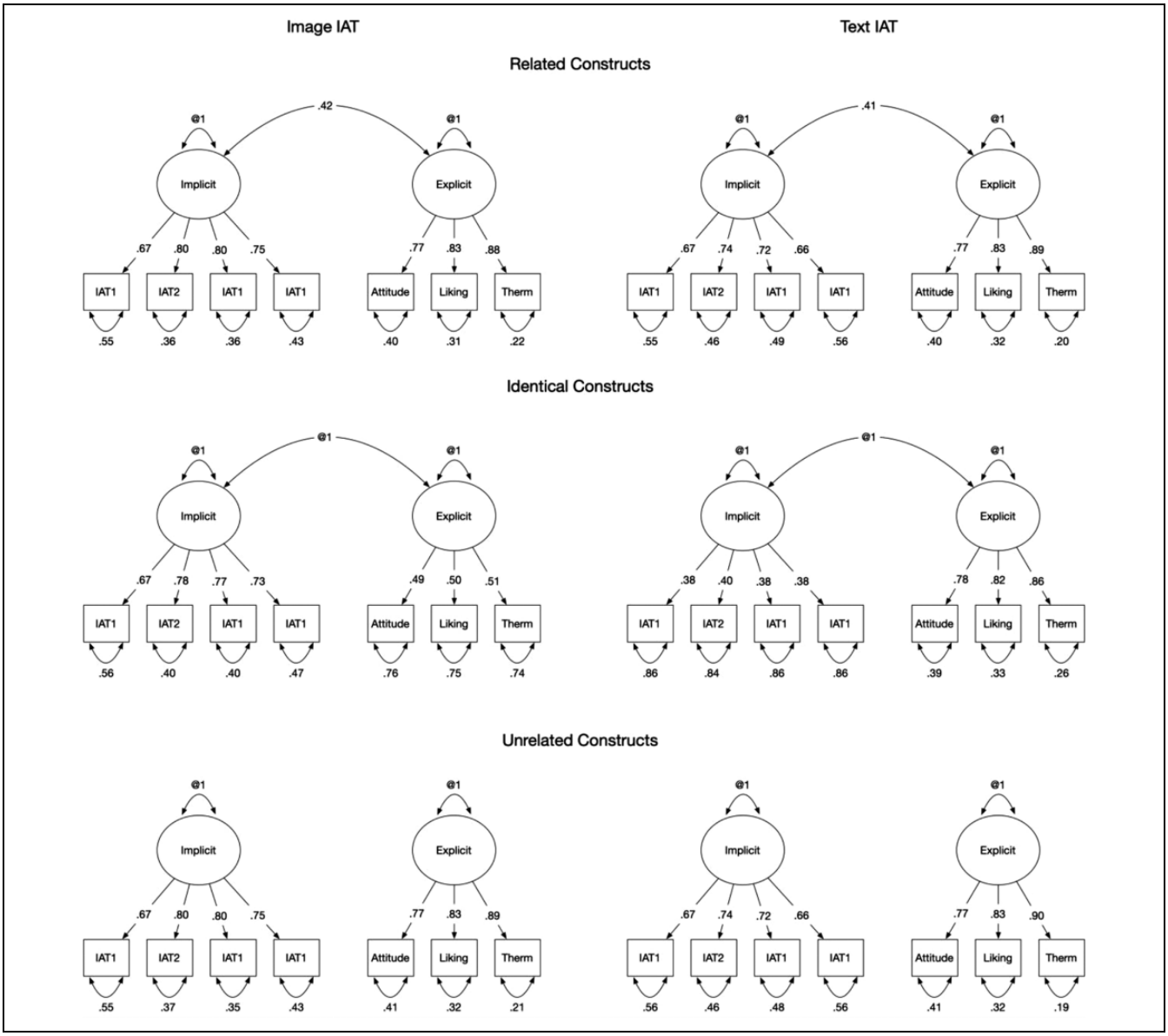

Figure 2. Path diagrams for the structural equation models testing construct independence in Study 3a. *Note.* Means for all manifest variables were estimated (not shown here). All coefficients represent standardized paths.

Correlations Between Transgender Attitudes and Outcome Measures

IAT *D* scores and the explicit preference variable reliably correlated with all outcome measures in the expected direction (all|*r*|s > .291, all *p*s < .001; see Online Supplement).

Predictive Validity of the Transgender IAT

Using a least squares linear regression analysis, implicit and explicit transgender attitudes independently predicted all eight outcome measures (all|β|s > 0.11, all *t*s > 2.40, all *p*s < .017; see Online Supplement).

Similarly, structural equation modeling analyses found evidence for incremental predictive validity of the implicit construct for all eight outcomes (all χ^2s > 4.41, all *p*s < .036). All SEM path coefficients were in the same direction as in the regression analyses. See Table 7.

SEM Meta-Analysis of Incremental Predictive Validity

Given the conflicting results of the SEM analyses for the image IAT in Studies 3a and 3b, we ran an additional set of models that aggregated across samples. For each outcome measure, we set up a structural equation model containing

Table 6. Model Fit Statistics for SEM Measurement Models in Study 3a.

Model	AIC	CFI	TLI	RMSEA	*df*	−2LL	Comparison Δ−2LL	w/Related *p*
Related constructs								
Image	16,056.42	0.994	0.991	0.034	17,989	52,034.42	—	—
Text	16,828.07	0.996	0.993	0.027	18,982	54,792.07	—	—
Unrelated constructs								
Image	18,921.26	0.64	0.47	0.28	17,990	54,901.26	2,866.85	<.001
Text	19,123.87	0.68	0.53	0.24	18,983	57,089.87	2,297.80	<.001
Identical constructs								
Image	16,402.67	0.95	0.93	0.11	17,990	52,382.67	348.26	<.001
Text	17,152.51	0.95	0.93	0.093	18,983	55,118.51	326.44	<.001

Note. All values based on tests with 1 *df*. SEM = structural equation modeling; AIC = Akaike information criterion; CFI = comparative fit index; TLI = Tucker–Lewis index; RMSEA = root mean square error of approximation; −2LL = −2 log likelihood.

Table 7. Coefficients and Test Statistics for SEM Analyses in Study 3b.

Outcome	AIC	CFI	TLI	RMSEA	Explicit β	Implicit β	Model Δ−2LL	Comparison *p*
1. Policy support								
Full Model	14,196.97	0.996	0.993	0.027	–0.79 [-0.93, -0.65]	−0.79 [-1.11, -0.48]	—	—
Explicit-Only Model	14,218.32	0.992	0.989	0.035	–0.95 [-1.08, -0.82]	—	23.35	<.001
2. Relationship interest								
Full Model	14,690.12	0.996	0.993	0.027	–0.88 [-1.06, -0.70]	−1.34 [-1.82, -0.86]	—	—
Explicit-Only Model	14,717.62	0.991	0.987	0.037	–1.11 [-1.28, -0.95]	—	29.50	<.001
3. Transgender contact								
Full Model	14,344.35	0.994	0.990	0.032	–0.53 [-0.66, -0.39]	−0.34 [-0.67, -0.02]	—	—
Explicit-Only Model	14,346.77	0.993	0.990	0.033	–0.60 [-0.71, -0.48]	—	4.41	.036
4. Attitude and Belief Scale								
Full Model	13,635.67	0.993	0.990	0.033	–0.63 [-0.70, -0.55]	−0.25 [-0.41, -0.09]	—	—
Explicit-Only Model	13,642.60	0.992	0.989	0.035	–0.68 [-0.74, -0.61]	—	8.93	.003
5. Transgender misconceptions								
Full Model	14,066.29	0.996	0.993	0.027	0.69 [0.56, 0.81]	0.32 [0.03, 0.60]	—	—
Explicit-Only Model	14,068.98	0.995	0.993	0.028	0.75 [0.65, 0.86]	—	4.69	.030
6. Gender essentialism								
Full Model	14,387.51	0.994	0.990	0.033	0.86 [0.70, 1.02]	0.59 [0.23, 0.95]	—	—
Explicit-Only Model	14,395.57	0.992	0.989	0.035	0.98 [0.83, 1.12]	—	10.06	.002
7. Benevolent sexism								
Full Model	14,072.87	0.995	0.992	0.029	0.31 [0.19, 0.43]	0.52 [0.21, 0.84]	—	—
Explicit-Only Model	14,081.34	0.994	0.991	0.032	0.41 [0.30, 0.52]	—	10.47	.001
8. Hostile sexism								
Full Model	14,135.42	0.994	0.991	0.030	0.58 [0.45, 0.71]	0.42 [0.08, 0.76]	—	—
Explicit-Only Model	14,139.18	0.994	0.991	0.031	0.66 [0.55, 0.78]	—	5.77	.016

Note. All values based on tests with 1 *df*. Values in brackets are 95% confidence intervals. SEM = structural equation modeling; AIC = Akaike information criterion; CFI = comparative fit index; TLI = Tucker–Lewis index; RMSEA = root mean square error of approximation; −2LL = −2 log likelihood.

two subgroups, one for Study 3a and one for Study 3b, that matched the full models of their respective studies. In our base model, we allowed all parameters to freely vary across both subgroups. In our meta-analytic models, we constrained the loadings on the latent constructs, the covariance between the latent constructs, and the pathways between the latent constructs and the outcome measure to be equal across the two subgroups, while still allowing for variation in the manifest variables.

We found that these constraints led to no significant loss of fit across any of the eight outcomes, indicating that the structures and relations across the two samples are similar enough for our meta-analytic approach to provide interpretable parameters (see Table 8). To test for meta-analytic incremental predictive validity, we then further constrained each meta-analytic model by removing the pathway from the implicit latent construct to the outcome measure and testing for a loss in model fit, as in Studies 3a and 3b. Using this

Table 8. Fit and Test Statistics for SEM Meta-Analytic Models, Studies 3a and 3b.

Outcome	AIC	CFI	TLI	RMSEA	Model Δ−2LL	Comparison *p*
1. Policy support						
Free model	30,630.97	0.995	0.993	0.020	—	—
Meta-analytic model	30,621.53	0.995	0.994	0.018	6.57	.584
2. Relationship interest						
Free model	31,637.90	0.995	0.992	0.021	—	—
Meta-analytic model	31,624.13	0.995	0.994	0.018	2.23	.973
3. Transgender contact						
Free model	30,992.84	0.994	0.990	0.023	—	—
Meta-analytic model	30,980.93	0.994	0.992	0.020	4.08	.850
4. Attitude and Belief Scale						
Free model	29,482.27	0.993	0.990	0.024	—	—
Meta-analytic model	29,469.26	0.994	0.992	0.021	3.00	.935
5. Transgender misconceptions						
Free model	30,363.19	0.995	0.993	0.020	—	—
Meta-analytic model	30,350.11	0.996	0.994	0.017	2.92	.940
6. Gender essentialism						
Free model	31,051.83	0.994	0.990	0.023	—	—
Meta-analytic model	31,041.94	0.994	0.992	0.020	6.11	.635
7. Benevolent sexism						
Free model	30,436.81	0.995	0.992	0.021	—	—
Meta-analytic model	30,421.87	0.995	0.994	0.018	1.07	.998
8. Hostile sexism						
Free model	30,527.83	0.995	0.992	0.020	—	—
Meta-analytic model	30,513.39	0.995	0.994	0.018	1.55	.992

Note. All values based on tests with 8 *df*. Values in brackets are 95% confidence intervals. SEM = structural equation modeling; AIC = Akaike information criterion; CFI = comparative fit index; TLI = Tucker–Lewis index; RMSEA = root mean square error of approximation; −2LL = −2 log likelihood.

approach, we found meta-analytic evidence for the incremental predictive validity of the IAT for seven of the eight outcomes, with marginal evidence ($p = .051$) for the eighth, transgender misconceptions. See Table 9 for meta-analytic coefficients.

General Discussion

Two measures of implicit transgender attitudes revealed that implicit and explicit transgender attitudes reflect distinct but related constructs. Both explicit and implicit attitude measures showed robust preferences for cisgender (over transgender) people, the strength of which were moderated by sexual orientation and gender identity. Even after accounting for explicit transgender attitudes, implicit transgender attitudes predicted meaningful outcomes, including transphobia, public policy support, interest in romantic relationships, prior contact, and general gender-related beliefs such as sexism and gender essentialism.

These findings emphasize the importance of implicit assessments of transgender attitudes; implicit measures provide information that people may not be willing (or able) to self-report. At the same time, our models suggest that explicit attitudes are more strongly related to these outcomes (meta-analytic median absolute *B* from Studies 3a and 3b for explicit attitudes = 0.66, for implicit attitudes = 0.49). However, this relationship may be complicated by response modality: As participants self-reported both explicit attitudes and our criterion measures, these outcomes share method variance, which may then inflate the observed relationship between them (see Buttrick et al, 2020, for further discussion).

Superiority of the Image-Based IAT

In Studies 1 through 3a, participants completed either an image or text version of the IAT. Although both measures showed evidence of validity for assessing implicit transgender attitudes, we consistently found superior validity for the image IAT. The image IAT exhibited greater internal reliability, higher mean-level effects of antitransgender attitudes, stronger correlations with many related outcomes, and maximized differences in attitudes between straight versus gay or lesbian participants (though not between cisgender and transgender participants). In total, there was not a single metric where the text IAT outperformed the image IAT.

For these reasons, we believe that future researchers should adopt the image IAT when assessing implicit transgender attitudes. However, these data cannot explain *why* the image IAT showed superior validity. There are several plausible explanations. For example, using images of well-known celebrities could have better clarified the concepts of cisgender and transgender people to participants. Similarly, people may rely on

Table 9. Coefficients and Test Statistics for Meta-Analytic SEM Analyses, Studies 3a and 3b.

Outcome	AIC	CFI	TLI	RMSEA	Explicit β	Implicit β	Model Δ−2LL	Comparison *p*
1. Policy support								
Full model	30,621.53	0.995	0.994	0.018	−0.84 [−0.94, −0.75]	−0.52 [−0.74, −0.30]	—	—
Explicit-only model	30,640.81	0.994	0.993	0.020	−0.95 [−1.03, −0.86]	—	21.28	<.001
2. Relationship interest								
Full model	31,624.13	0.995	0.994	0.018	−0.94 [−1.07, −0.81]	−1.20 [−1.53, −0.86]	—	—
Explicit-only model	31,671.27	0.992	0.990	0.023	−1.16 [−1.29, −1.04]	—	49.14	<.001
3. Transgender contact								
Full model	30,980.93	0.994	0.992	0.020	−0.47 [−0.55, −0.38]	−0.54 [−0.75, −0.33]	—	—
Explicit-only model	31,003.44	0.993	0.991	0.022	−0.57 [−0.65, −0.49]	—	24.51	<.001
4. Attitude and Belief Scale								
Full model	29,469.26	0.994	0.992	0.021	−0.60 [−0.65, −0.55]	−0.22 [−0.34, −0.11]	—	—
Explicit-only model	29,481.22	0.993	0.991	0.022	−0.64 [−0.69, −0.60]	—	13.95	<.001
5. Transgender misconceptions								
Full model	30,350.11	0.996	0.994	0.017	0.72 [0.64, 0.81]	0.18 [−0.00, 0.37]	—	—
Explicit-only model	30,351.92	0.995	0.994	0.017	0.76 [0.69, 0.84]	—	3.81	.051
6. Gender essentialism								
Full model	31,041.94	0.994	0.992	0.020	0.79 [0.68, 0.89]	0.41 [0.17, 0.65]	—	—
Explicit-only model	31,051.36	0.993	0.992	0.021	0.87 [0.78, 0.96]	—	11.43	.001
7. Benevolent sexism								
Full model	30,421.87	0.995	0.994	0.018	0.31 [0.23, 0.38]	0.52 [0.32, 0.73]	—	—
Explicit-only model	30,444.45	0.994	0.992	0.020	0.40 [0.33, 0.47]	—	24.58	<.001
8. Hostile sexism								
Full model	30,513.39	0.995	0.994	0.018	0.59 [0.50, 0.67]	0.46 [0.25, 0.68]	—	—
Explicit-only model	30,529.56	0.994	0.993	0.020	0.67 [0.60, 0.75]	—	18.18	<.001

Note. All values based on tests with 1 *df*. Values in brackets are 95% confidence interval. SEM = structural equation modeling; AIC = Akaike information criterion; CFI = comparative fit index; TLI = Tucker–Lewis index; RMSEA = root mean square error of approximation; −2LL = −2 log likelihood.

these prominent transgender figures when forming their attitudes about transgender people, and the respect or warmth that some participants felt toward these celebrities may better capture their attitudes toward transgender people in general. Alternatively, the text IAT could have suffered from a lack of variability in stimuli (an issue that does not appear to be easily remedied), or less activation of the underlying associations themselves. That is, although the image IAT may have required deeper cognitive processing to classify celebrity stimuli into their gender categories, the text IAT may have enabled more superficial semantic feature matching (i.e., all stimuli for the "transgender" category start with the prefix "trans-"; all stimuli for the "cisgender" category start with the prefix "cis-"). The image IAT's superior performance could even simply be a result of the extra training block included to familiarize participants with the celebrity stimuli. Disentangling these explanations could be a focus of future research, but the present evidence is clear on the superiority of the image IAT for assessing the global construct of implicit transgender attitudes.

In addition, the Online Supplement details two studies that further support the image IAT's validity. Study S1 ($N = 720$) again demonstrated known-groups validity, with heterosexual participants exhibiting more negative implicit transgender associations than gay and lesbian participants ($d = 0.46$, $p = .008$), as well as reliable correlations between the IAT and explicit transphobia ($r = .32$, $p < .001$) and support for transgender-related policies ($r = -.19$, $p < .001$). Study S2 ($N = 415$) also used a sample of participants reporting no explicit preference for transgender versus cisgender people and found that the image IAT predicted self-reported transphobia ($r = .26$, $p < .001$) and support for transgender-related policies ($r = -.16$, $p = .002$).

One concern with the image IAT is its possible dependence on participants' familiarity with the transgender celebrities used as stimuli, despite past research suggesting IAT category labels are far more important than the specific stimuli (Dasgupta & Greenwald, 2001). To investigate this issue, a subset of participants ($N = 1{,}175$) in Study 3a rated their familiarity with all the transgender and cisgender celebrities used as stimuli (1 = *not at all*, 4 = *extremely*). Participants who were not familiar with any of the transgender celebrities exhibited acceptable levels of reliability on the IAT ($\alpha = .80$) relative to participants who reported being at least "a little" familiar with each transgender celebrity ($\alpha = .82$). Even participants unfamiliar with the stimuli still showed higher levels of internal reliability on the image IAT than the text IAT ($\alpha = .66$). Although stimuli familiarity may be helpful, it does not appear to be a requirement to achieve satisfactory measurement.

However, one weakness of this research is the exclusive use of volunteer samples from Project Implicit. Visitors to

Project Implicit are likely to be more intrinsically interested in the topics of implicit attitudes and intergroup bias. It is possible that samples from different sources or more representative samples would fail to show the effects observed here. Exploring this question in future uses of these measures will be informative, though we cannot identify a plausible reason to expect this lack of generalizability.

Another possible limitation is that we did not restrict analyses to U.S. citizens. Including citizens of multiple countries could have introduced differing levels of familiarity or knowledge about transgender issues among our sample, which in turn may have affected results. Across Studies 1 to 3b, 83.4% of participants came from four countries (United States = 70.0%, United Kingdom = 6.3%, Canada = 4.7%, Australia = 2.4%). In the Online Supplement, we report analyses investigating whether U.S. citizenship moderated (a) the relative difference between *D* scores on the image versus text IAT and (b) the strength of the relationship between *D* scores and any of our self-reported outcome variables. Using a $p < .05$ threshold, none of the 39 analyses found reliable differences between U.S. citizens and non-U.S. citizens. That said, future studies collecting more nationally diverse samples will increase the generalizability of these results.

Implicit Transgender Attitudes Independently Predict Meaningful Beliefs and Experiences

Using simultaneous linear regression and SEM analyses, we found evidence for incremental predictive validity of the image transgender IAT above and beyond self-reported explicit preferences. People with stronger implicit preferences for cisgender over transgender people reported greater transphobia, had less experience with (and were less willing to consider) romantic relationships with a transgender person, and had more infrequent contact with (or knew) fewer transgender people. This last finding is notable in that evidence for the contact hypothesis in the existing literature on transgender attitudes has been mixed (Flores, 2015).

Implicit transgender attitudes were also related to more general gender-based beliefs. People with stronger implicit preferences for cisgender (over transgender) people reported higher rates of hostile and benevolent sexism, consistent with a pattern of ambivalent sexism in which subjectively positive (but stereotyped and restrictive) feelings toward women coexist with sexist antipathy or prejudice (Glick & Fiske, 1996). This result replicates previous work showing that ambivalent sexism is associated with explicit transgender attitudes (Nagoshi et al., 2008), and extends the finding to implicit attitudes.

Studies 3a and 3b are noteworthy because they present one of the first uses of SEM to show evidence for the incremental predictive validity of implicit attitudes. The few existing tests of incremental predictive validity of implicit associations using SEM have produced positive (Axt et al., 2019), negative (Brick & Lai, 2018), and mixed (Buttrick et al., 2020) results. The present work expands this literature by providing evidence for the incremental predictive validity of implicit attitudes for a number of outcomes.

However, although this work shows implicit transgender attitudes predict relevant outcomes, they provide no evidence that implicit attitudes are *causally* related to such outcomes. Indeed, evidence that changes in implicit attitudes are associated with changes in relevant behavior is inconclusive (Forscher et al., 2019). Thus, having established these correlational relationships, it is critical that subsequent work test whether implicit transgender attitudes have a causal effect. Manipulations targeting implicit associations may be an avenue for interventions seeking to change beliefs about transgender people, complementing existing interventions that target propositional knowledge (e.g., Broockman & Kalla, 2016).

Implicit Favoritism Among Transgender Participants

A strength of the present research is its large sample sizes and inclusion of transgender participants. To our knowledge, this work presents the first estimate of general implicit transgender attitudes (i.e., toward "transgender people" as the focal category) among transgender participants. One intriguing result is that transgender participants completing the image IAT ($N = 101$ across Studies 3a and 3b) showed implicit ingroup favoritism ($d = 0.42$) at levels nearly identical to their cisgender counterparts ($d = 0.44$). These results are striking because they contrast starkly with a lack of implicit ingroup favoritism on the IAT found in other minority populations, such as in race (e.g., Nosek et al., 2007) and religion (Rudman et al., 2002). A related exception comes from sexual orientation, which has shown consistent implicit ingroup favoritism in lesbian- and gay-identified populations (Westgate et al., 2015).

More notably, these results differ from previous work assessing implicit transgender attitudes. In Wang-Jones et al. (2017), participants classified as transgender ($N = 42$) showed no ingroup favoritism on IATs measuring associations toward "transsexual men" (vs. "biological men") or "transsexual women" (vs. "biological women"). One potential explanation may come from differing methods for classifying transgender participants. In Wang-Jones et al., 32 of 42 participants in the subsample identified as "agender, gender-fluid, gender-queer, non-binary"; in other words, only 10 participants labeled themselves as transgender when given the option. The more stringent classification method used here may present a more accurate depiction of the implicit ingroup favoritism of transgender people. Further exploring the causes behind this ingroup favoritism should be a focus of future work, in addition to studies that directly compare the predictive validity and level of ingroup favoritism produced by this image IAT and the measure used in Wang-Jones et al.

Transgender Attitudes and Gender Essentialism

These findings also demonstrate a positive correlation between anti-transgender attitudes and gender essentialism.

Here, essentialism assessed the belief that there are fundamental differences between genders, and that these differences should dictate the roles or opportunities available to each gender (e.g., Smiler & Gelman, 2008). Previous work has found that endorsement of the gender binary—a component of gender essentialism—is related to more negative explicit attitudes toward transgender people (Norton & Herek, 2013), but this is the first empirical evidence for a relationship between the broader construct of gender *essentialism* and attitudes toward transgender people. Although this may seem unsurprising, it contrasts with related work finding that essentialist beliefs about sexual orientation predict more *positive* attitudes toward lesbian and gay people (Roberts et al., 2017). One possible explanation is that transgender people may challenge rigid gender conceptions differently than lesbian or gay people (Ching & Xu, 2018).

However, it is also possible that "gender essentialism"—such as essentialist beliefs about sexual orientation—could be construed in a manner that would predict more favorable attitudes toward transgender people. Endorsing gender essentialism as the belief that individuals are born with an "essential" gender identity (or lack thereof) that need not align with sex assigned at birth would likely correlate with more positive transgender attitudes. For example, belief that transgender identity itself has a biological basis has been associated with more positive attitudes toward transgender people (Landén & Innala, 2000). Similarly, in Study 3a, greater agreement with the item "Whether a person is male or female depends upon whether they feel male or female" was associated with less negative transgender attitudes, both implicitly (image IAT $r = -.28$, $p < .001$) and explicitly ($r = -.54$, $p < .001$). Subsequent research on this topic will benefit from understanding how different forms of gender essentialist beliefs relate to attitudes and behaviors concerning transgender people.

Available Resources and Future Uses

We hope researchers will find the transgender IAT useful in studying implicit transgender attitudes. To aid in that goal, we have made all data and materials available, and have programmed an Inquisit version of the image transgender IAT. These resources can be accessed at https://osf.io/rcgdx/.

We anticipate that this measure of implicit transgender attitudes will assist researchers in understanding how such attitudes relate to other beliefs or behaviors concerning transgender people, as well as how implicit transgender attitudes change over time. Given evidence of changes in implicit attitudes toward gay people (Westgate et al., 2015), similar changes in implicit attitudes toward transgender people may occur in the coming years. The IAT introduced here could also be useful to researchers and the public in raising awareness of transphobia. Although the transgender community has been historically underresearched and underrepresented in psychological literature, that is changing (Tompkins et al., 2015). Future research may contribute to greater awareness in addressing how implicit and explicit attitudes affect the daily lives of transgender people.

Authors' Note

Jordan Axt and Morgan Conway contributed equally to this work. All data and study materials are available at the project page on the Open Science Framework (https://osf.io/rcgdx/). All measures, manipulations, and exclusions in the studies are disclosed.

Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: This research was partly supported by Project Implicit. J. R. Axt is director of data and methodology and N.R. Buttrick is a consultant for Project Implicit, Inc., a nonprofit organization with the mission to "develop and deliver methods for investigating and applying phenomena of implicit social cognition, including especially phenomena of implicit bias based on age, race, gender, or other factors." There are no other potential conflicts of interest with respect to authorship or the publication of this article.

Funding

The author(s) received the following financial support for the research, authorship, and/or publication of this article: This research was partly supported by Project Implicit.

ORCID iD

Jordan R. Axt https://orcid.org/0000-0003-3944-8331

Supplemental Material

Supplemental material is available online with this article.

Notes

1. Study 3a also included items regarding cisgender and transgender men and women (see online data set).
2. This measure also included items about contact with gay and bisexual people (available online).

References

Associated Press. (2017, July 17). Lawsuit says North Carolina "bathroom bill" effects still felt. *Los Angeles Times*. http://www.latimes.com/nation/nationnow/la-na-nc-bathroom-bill-lawsuit-20170721-story.html

Axt, J. R. (2018). The best way to measure explicit racial attitudes is to ask about them. *Social Psychological and Personality Science*, *9*, 896-906. https://doi.org/10.1177/1948550617728995

Axt, J. R., Bar-Anan, Y., & Vianello, M. (2019). The relation between evaluation and racial categorization of emotional faces. *Social Psychological and Personality Science*, *11*, 196-206. https://doi.org/10.1177/1948550619848000

Bar-Anan, Y., & Nosek, B. A. (2014). A comparative investigation of seven indirect attitude measures. *Behavior Research Methods*, *46*, 668-688. https://doi.org/10.3758/s13428-013-0410-6

Brice-Saddler, M. (2019, January 10). Two women charged with sexually assaulting a transgender woman in a North Carolina bar

bathroom. *Washington Post*. https://www.washingtonpost.com/nation/2019/01/09/two-north-carolinians-charged-with-sexually-assaulting-transgender-woman-bar-bathroom/?noredirect=on&utm_term=.ba4dac1dd3eb

Brick, C., & Lai, C. K. (2018). Explicit (but not implicit) environmentalist identity predicts pro-environmental behavior and policy preferences. *Journal of Environmental Psychology*, *58*, 8-17. https://doi.org/10.1016/j.jenvp.2018.07.003

Broockman, D., & Kalla, J. (2016). Durably reducing transphobia: A field experiment on door-to-door canvassing. *Science*, *352*(6282), 220-224. https://doi.org/10.1126/science.aad9713

Buttrick, N. R., Axt, J. R., Ebersole, C. R., & Huband, J. (2020). Reassessing the incremental predictive validity of Implicit Association Tests. *Journal of Experimental Social Psychology*, *88*, 103941. https://doi.org/10.1016/j.jesp.2019.103941

Charlesworth, T. E., & Banaji, M. R. (2019). Patterns of implicit and explicit attitudes: I. Long-term change and stability from 2007 to 2016. *Psychological Science*, *30*, 174-192. https://doi.org/10.1177/0956797618813087

Ching, B. H. H., & Xu, J. T. (2018). The effects of gender neuroessentialism on transprejudice: An experimental study. *Sex Roles*, *78*(3–4), 228-241. https://doi.org/10.1007/s11199-017-0786-3

Cronbach, L. J. (1955). Processes affecting scores on understanding of others and assumed similarity. *Psychological Bulletin*, *52*, 177-193. http://doi.org/10.1037/h0044919

Dasgupta, N., & Greenwald, A. G. (2001). On the malleability of automatic attitudes: Combating automatic prejudice with images of admired and disliked individuals. *Journal of Personality and Social Psychology*, *81*(5), 800-814. http://doi.org/10.1037/0022-3514.81.5.800

Diamond, J. (2017, August 25). Trump signs directive banning transgender military recruits. http://www.cnn.com/2017/08/25/politics/trump-transgender-military/index.html

Feldt, L. S. (1969). A test of the hypothesis that Cronbach's alpha or Kuder-Richardson coefficient twenty is the same for two tests. *Psychometrika*, *34*(3), 363-373. https://doi.org/10.1007/BF02289364

Fiske, S. T., Cuddy, A. J., Glick, P., & Xu, J. (2002). A model of (often mixed) stereotype content: Competence and warmth respectively follow from perceived status and competition. *Journal of Personality and Social Psychology*, *82*, 878-902. https://doi.org/10.1037/pspa0000163

Flores, A. R. (2015). Attitudes toward transgender rights: Perceived knowledge and secondary interpersonal contact. *Politics, Groups, and Identities*, *3*, 398-416. https://doi.org/10.1080/21565503.2015.1050414

Forscher, P. S., Lai, C. K., Axt, J. R., Ebersole, C. R., Herman, M., Devine, P. G., & Nosek, B. A. (2019). A meta-analysis of procedures to change implicit measures. *Journal of Personality and Social Psychology*, *117*, 522-559. https://doi.org/10.1037/pspa0000160

Gates, G. J. (2011). *How many people are lesbian, gay, bisexual and transgender?* UCLA: The Williams Institute. https://escholarship.org/uc/item/09h684x2

Gawronski, B., & Bodenhausen, G. V. (2007). Unraveling the processes underlying evaluation: Attitudes from the perspective of the APE model. *Social Cognition*, *25*(5), 687-717. https://doi.org/10.1521/soco.2007.25.5.687

Glick, P., & Fiske, S. T. (1996). The Ambivalent Sexism Inventory: Differentiating hostile and benevolent sexism. *Journal of Personality and Social Psychology*, *70*(3), 491-512. http://doi.org/10.1037/0022-3514.70.3.491

Govan, C. L., & Williams, K. D. (2004). Changing the affective valence of the stimulus items influences the IAT by re-defining the category labels. *Journal of Experimental Social Psychology*, *40*(3), 357-365. https://doi.org/10.1016/j.jesp.2003.07.002

Greenwald, A. G., & Banaji, M. R. (1995). Implicit social cognition: Attitudes, self-esteem, and stereotypes. *Psychological Review*, *102*, 4-27. http://doi.org/10.1037/0033-295X.102.1.4

Greenwald, A. G., & Lai, C. K. (2020). Implicit social cognition. *Annual Review of Psychology*, *20*, 419-445. https://doi.org/10.1146/annurev-psych-010419-050837

Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. K. (1998). Measuring individual differences in implicit cognition: The Implicit Association Test. *Journal of Personality and Social Psychology*, *74*(6), 1464-1480. http://doi.org/10.1037/0022-3514.74.6.1464

Greenwald, A. G., Nosek, B. A., & Banaji, M. R. (2003). Understanding and using the Implicit Association Test: I. An improved scoring algorithm. *Journal of Personality and Social Psychology*, *85*(2), 197-216. http://doi.org/10.1037/0022-3514.85.2.197

Gülgöz, S., Glazier, J. J., Enright, E. A., Alonso, D. J., Durwood, L. J., Fast, A. A., . . . Olson, K. R. (2019). Similarity in transgender and cisgender children's gender development. *Proceedings of the National Academy of Sciences*, *116*, 24480-24485. https://doi.org/10.1073/pnas.1909367116

Halloran, L. (2015). *Survey shows striking increase in Americans who know and support transgender people*. https://www.hrc.org/blog/survey-shows-striking-increase-in-americans-who-know-and-support-transgende

Hettinger, V. (2014). *Reconceptualizing the role of essentialism in attitudes toward gays and lesbians: The intersection of gender and sexual orientation* [Doctoral dissertation]. http://scholarcommons.usf.edu/etd/5040/

Jost, J. T., Banaji, M. R., & Nosek, B. A. (2004). A decade of system justification theory: Accumulated evidence of conscious and unconscious bolstering of the status quo. *Political Psychology*, *25*(6), 881-919. https://doi.org/10.1111/j.1467-9221.2004.00402.x

Kanamori, Y., Cornelius-White, J. H., Pegors, T. K., Daniel, T., & Hulgus, J. (2017). Development and validation of the Transgender Attitudes and Beliefs Scale. *Archives of Sexual Behavior*, *46*(5), 1503-1515. https://doi.org/10.1007/s10508-016-0840-1

King, M. E., Winter, S., & Webster, B. (2009). Contact reduces transprejudice: A study on attitudes towards transgenderism and transgender civil rights in Hong Kong. *International Journal of Sexual Health*, *21*(1), 17-34. https://doi.org/10.1080/19317610802434609

Kline, R. B. (2005). *Principles and practice of structural equation modeling* (2nd ed.). Guilford Press.

Kurdi, B., Seitchik, A. E., Axt, J. R., Carroll, T. J., Karapetyan, A., Kaushik, N., … Banaji, M. R. (2019). Relationship between the Implicit Association Test and intergroup behavior: A meta-analysis. *American Psychologist*, *74*, 569-586. https://doi.org/10.1037/amp0000364

Landén, M., & Innala, S. (2000). Attitudes toward transsexualism in a Swedish national survey. *Archives of Sexual Behavior*, *29*, 375-388. https://doi.org/10.1023/A:1001970521182

Lax, J. R., & Phillips, J. H. (2009). Gay rights in the states: Public opinion and policy responsiveness. *American Political Science Review*, *103*, 367-386. https://doi.org/10.1017/S0003055409990050

Miller, P. R., Flores, A. R., Haider-Markel, D. P., Lewis, D. C., Tadlock, B. L., & Taylor, J. K. (2017). Transgender politics as body politics: Effects of disgust sensitivity and authoritarianism on transgender rights attitudes. *Politics, Groups, and Identities*, *5*(1), 4-24. https://doi.org/10.1080/21565503.2016.1260482

Nagoshi, J. L., Adams, K. A., Terrell, H. K., Hill, E. D., Brzuzy, S., & Nagoshi, C. T. (2008). Gender differences in correlates of homophobia and transphobia. *Sex Roles*, *59*(7–8), 521-531. https://doi.org/10.1007/s11199-008-9458-7

Norton, A. T., & Herek, G. M. (2013). Heterosexuals' attitudes toward transgender people: Findings from a national probability sample of US adults. *Sex Roles*, *68*(11–12), 738-753. https://doi.org/10.1007/s11199-011-0110-6

Nosek, B. A. (2005). Moderators of the relationship between implicit and explicit evaluation. *Journal of Experimental Psychology: General*, *134*(4), 565-584. https://doi.org/10.1037/0096-3445.134.4.565

Nosek, B. A. (2007). Implicit–explicit relations. *Current Directions in Psychological Science*, *16*, 65-69. https://doi.org/10.1111/j.1467-8721.2007.00477.x

Nosek, B. A., Bar-Anan, Y., Sriram, N., Axt, J. R., & Greenwald, A. G. (2014). Understanding and using the Brief Implicit Association Test: Recommended scoring procedures. *PLOS ONE*, *9*, Article e110938. https://doi.org/10.1371/journal.pone.0110938

Nosek, B. A., & Smyth, F. L. (2007). A multitrait-multimethod validation of the Implicit Association Test. *Experimental Psychology*, *54*(1), 14-29. https://doi.org/10.1027/1618-3169.54.1.14

Nosek, B. A., Smyth, F. L., Hansen, J. J., Devos, T., Lindner, N. M., Ranganath, K. A., … Banaji, M. R. (2007). Pervasiveness and correlates of implicit attitudes and stereotypes. *European Review of Social Psychology*, *18*(1), 36-88. https://doi.org/10.1080/10463280701489053

Olson, K. R., Key, A. C., & Eaton, N. R. (2015). Gender cognition in transgender children. *Psychological Science*, *26*, 467-474. https://doi.org/10.1177/0956797614568156

Oswald, F. L., Mitchell, G., Blanton, H., Jaccard, J., & Tetlock, P. E. (2013). Predicting ethnic and racial discrimination: A meta-analysis of IAT criterion studies. *Journal of Personality and Social Psychology*, *105*(2), 171-192. https://doi.org/10.1037/a0032734

Roberts, S. O., Ho, A. K., Rhodes, M., & Gelman, S. A. (2017). Making boundaries great again: Essentialism and support for boundary-enhancing initiatives. *Personality and Social Psychology Bulletin*, *43*(12), 1643-1658. https://doi.org/10.1177/0146167217724801

Rudman, L. A., Feinberg, J., & Fairchild, K. (2002). Minority members' implicit attitudes: Automatic ingroup bias as a function of group status. *Social Cognition*, *20*(4), 294–320. https://doi.org/10.1521/soco.20.4.294.19908

Sesko, A. K., & Biernat, M. (2010). Prototypes of race and gender: The invisibility of Black women. *Journal of Experimental Social Psychology*, *46*(2), 356-360. https://doi.org/10.1016/j.jesp.2009.10.016

Smiler, A. P., & Gelman, S. A. (2008). Determinants of gender essentialism in college students. *Sex Roles*, *58*(11–12), 864-874. https://doi.org/10.1007/s11199-008-9402-x

Sriram, N., & Greenwald, A. G. (2009). The brief Implicit Association Test. *Experimental Psychology*, *56*, 283-294. https://doi.org/10.1027/1618-3169.56.4.283

Tompkins, T. L., Shields, C. N., Hillman, K. M., & White, K. (2015). Reducing stigma toward the transgender community: An evaluation of a humanizing and perspective-taking intervention. *Psychology of Sexual Orientation and Gender Diversity*, *2*(1), 34-42. http://doi.org/10.1037/sgd0000088

Van Kesteren, P. J., Gooren, L. J., & Megens, J. A. (1996). An epidemiological and demographic study of transsexuals in the Netherlands. *Archives of Sexual Behavior, 25*(6), 589–600. https://doi.org/10.1007/BF02437841

Wang-Jones, T. T. S., Alhassoon, O. M., Hattrup, K., Ferdman, B. M., & Lowman, R. L. (2017). Development of gender identity Implicit Association Tests to assess attitudes toward transmen and transwomen. *Psychology of Sexual Orientation and Gender Diversity*, *4*(2), 169-183. http://doi.org/10.1037/sgd0000218

Wang-Jones, T. T. S., Hauson, A. O., Ferdman, B. M., Hattrup, K., & Lowman, R. L. (2018). Comparing implicit and explicit attitudes of gay, straight, and non-monosexual groups toward transmen and transwomen. *International Journal of Transgenderism*, *19*, 95-106. https://doi.org/10.1080/15532739.2018.1428138

Westfall, J., & Yarkoni, T. (2016). Statistically controlling for confounding constructs is harder than you think. *PLOS ONE*, *11*(3), Article e0152719. https://doi.org/10.1371/journal.pone.0152719

Westgate, E. C., Riskind, R. G., & Nosek, B. A. (2015). Implicit preferences for straight people over lesbian women and gay men weakened from 2006 to 2013. *Collabra*, *1*(1), Article 1. http://doi.org/10.1525/collabra.1

Willoughby, B. L., Hill, D. B., Gonzalez, C. A., Lacorazza, A., Macapagal, R. A., Barton, M. E., & Doty, N. D. (2010). Who hates gender outlaws? A multisite and multinational evaluation of the Genderism and Transphobia Scale. *International Journal of Transgenderism*, *12*(4), 254-271. http://doi.org/10.1080/15532739.2010.550821

Worthen, M. G. (2013). An argument for separate analyses of attitudes toward lesbian, gay, bisexual men, bisexual women, MtF and FtM transgender individuals. *Sex Roles*, *68*, 703-723. https://doi.org/10.1007/s11199-012-0155-1