

Implicit transgender attitudes independently predict some (but not all) gender and transgender-related beliefs

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Author Biographies

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Abstract

Growing public awareness of the issues facing the transgender community has highlighted the dearth of measures available to predict beliefs about transgender people. Two studies introduce and validate a novel Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998) assessing implicit attitudes towards transgender people. Study 1 ($N = 259$) finds that implicit and explicit transgender attitudes were reliably associated with self-reported transphobia and support for transgender-related policies. Study 2 ($N = 2276$) finds that, after controlling for explicit transgender attitudes, implicit attitudes predict contact with transgender people, belief in misconceptions about transgender people, gender essentialism, and hostile and benevolent sexism, but not transphobia or transgender-related policies. This work introduces a reliable measure of implicit transgender attitudes and illustrates how such attitudes independently predict meaningful beliefs or experiences.

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Implicit transgender attitudes independently predict some (but not all) gender and transgender-related beliefs

Roughly half of one percent of the American adult population identifies as transgender (i.e., having a gender identity differing from the one assigned at birth; Tompkins et al., 2015), and between 2-5% experience gender dysphoria (Gates, 2011; Van Kesteren, Gooren, & Megens, 1996). Visibility of transgender people in the past several years has grown markedly, with increasing numbers of people reporting they know a transgender person (Halloran, 2015). However, transgender people continue to be victims of discrimination, including legislative efforts to restrict transgender people's public bathroom access (Associated Press, 2016) and efforts to ban transgender people from the military (Diamond, 2017). This heightened attention highlights the need to better understand how such behaviors relate to transgender attitudes.

Both self-reported and societal negative attitudes about transgender people and transphobia, or the emotional disgust felt towards people who do not conform to society's gender expectations (Grigoropoulos & Kordoutis, 2015; Norton & Herek, 2013; Nagoshi et al., 2008), are associated with negative outcomes for transgender people, including depression, physical violence, and employment discrimination (Almeida et al., 2009; Grant et al., 2011; Haas, Philip, Rogers, & Herman, 2014;). Transgender people who report perceiving and experiencing gender-based discrimination are at elevated risk for suicide (Tebbe & Moradi, 2016), and even seemingly small indignities like incorrect pronoun use (microaggressions; Nadal, Davidoff, Davis, & Wong, 2014) can lead to negative mental health outcomes.

To date, with one exception, research has only examined the association between transgender-related beliefs and behaviors with *explicit* transgender attitudes (i.e. attitudes consciously experienced and recognized as one's own; Greenwald & Banaji, 1995). However,

transphobia and beliefs about the treatment of transgender people may also be related to *implicit* transgender attitudes (i.e. automatically activated associations; Gawronski & Bodenhausen, 2007). Implicit and explicit attitudes towards a group may diverge (Nosek, Banaji, & Greenwald, 2002; Jost, Banaji, & Nosek, 2004), change at varying rates (Westgate, Riskind, & Nosek, 2015; Cao & Banaji, 2016), and differentially correlate with behavior (Hofmann, Gschwendner, Castelli, & Schmitt, 2008; Kurdi, Seitchik et al., in press; c.f., Oswald et al., 2013).

Implicit and explicit attitudes towards transgender people may likewise show similar discrepancies, differing in negativity or correlation with relevant beliefs and behaviors. The only existing measure of implicit transgender attitudes (Wang-Jones, Alhassoon, Hatrup, & Lowma, 2017; Wang-Jones, Hauson, Ferdman, Hatrup, & Lowman, 2018) measured attitudes toward transgender men and transgender women as separate categories rather than attitudes toward transgender people as a whole. While considering intersectionality and the differential experiences of transgender men and women is important, it is also critical to understand how people evaluate transgender people more globally. For example, a photograph of the same person can be labeled less attractive when the person is labelled as transgender (Mao, Hauptert, & Smith, 2018). Because perceived category labels strongly influence IAT performance and implicit attitude measurement (Govan & Williams, 2004), comparing associations towards “transgender people” (vs “cisgender people”) likely captures substantively different attitudes than those towards “transsexual men” (vs “biological men”) and “transsexual women” (vs “biological women”). Such labels base category membership on access to surgical interventions rather than individuals’ gender.

Moreover, there is no reliable evidence for the incremental predictive validity of implicit transgender attitudes relative to explicit transgender attitudes (i.e., whether implicit transgender

attitudes predict transgender beliefs or behaviors after controlling for explicit attitudes). Such evidence would suggest an independent role of implicit attitudes in understanding individuals' beliefs about transgender people and the unique causes driving their development. Most prior investigations into the incremental predictive validity of implicit attitudes have relied on linear regression, an analysis strategy known to inflate false positives (e.g., Westfall & Yarkoni, 2016). Establishing the incremental predictive validity of transgender attitudes through analyses that account for measurement reliability (i.e., structural equation modeling) can provide evidence for the predictive validity of both implicit transgender associations as well as implicit associations more generally.

The current work sought to expand prior research by developing the first measure of implicit attitudes towards transgender people as a singular category. We developed an Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998) using images of prominent transgender and cisgender celebrities. Across two studies, we validate the IAT and find that implicit transgender attitudes are associated with a number of beliefs and behaviors concerning transgender people and gender, and predict a number of these outcomes even after controlling for explicit transgender attitudes. Study 1 reports evidence for predictive validity and slight superiority of the celebrity image IAT over a text-based IAT. Study 2 provides evidence that implicit transgender attitudes independently predict a number of transgender-related outcomes even after controlling for explicit attitudes. We also report the first estimate of general implicit transgender attitudes among transgender participants themselves¹, and show evidence of robust ingroup favoritism in implicit attitudes among transgender individuals. Implicit attitudes towards transgender people can be reliably assessed, and such attitudes predict important outcomes.

¹ Wang-Jones et al. (2017) also report attitudes towards “transsexual women” and “transsexual men” among a sample consisting predominantly of individuals assigned female at birth but who now identify as non-binary

Study 1

Study 1 compared the validity of two IATs measuring implicit evaluations of transgender versus cisgender people. The first IAT used images of cisgender and transgender celebrities. We decided on celebrities for creating an image-based transgender IAT due to ethical and practical concerns. Using images of non-celebrities on a publicly available research website potentially violates the privacy of transgender people, who might be identified by site visitors. Likewise, generating novel stimuli through computer software would require researchers to impose top-down differences in appearance between transgender and cisgender stimuli, a practice that is potentially offensive and not empirically supported.

However, 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 unacceptably high error rates. Similarly, subtle differences in the transgender versus cisgender stimuli might reduce the measure's capacity to assess implicit transgender attitudes. Therefore, Study 1 compared the celebrity image-based transgender IAT to a text-based IAT using words directly related to transgender and cisgender people.

Given evidence of robust biases against transgender people in explicit (Willoughby, Hill, & Gonzalez, 2010) and implicit (Wang-Jones et al., 2017) attitudes, an IAT that produces larger anti-transgender implicit evaluations is more sensitive to the underlying construct and thus a superior measure (see Greenwald, Nosek, & Banaji, 2003 for similar rationale when validating IATs). In addition, since implicit and explicit attitudes are distinct but related constructs (Nosek & Smyth 2007; Nosek et al., 2007), an IAT producing stronger correlations with self-reported transgender attitudes and beliefs should also be considered a superior measure. Just as the correlation between height and weight – two distinct but related constructs - is weakened when

error is introduced into measurement, more accurate measures of implicit attitudes should maximize their correlation with explicit attitudes and other related outcomes (see Axt, 2018 for parallel reasoning). Study 1 thus compared the image and text IATs on the magnitude of anti-transgender evaluations, correlations with related self-report measures, internal reliability and error rates.

Method

Participants

306 volunteers at Project Implicit (<https://implicit.harvard.edu>; Nosek, 2005) completed both IATs. We sought a sample size that would provide more than 80% power for detecting a small within-subjects effect of $d = .20$. Participants completed demographics as part of registration ($M_{\text{Age}} = 38.7$, $SD = 14.2$; 71.6% White; 55.2% female; 59.8% US 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 Table 1 for 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 first shown short descriptions of each celebrity and then completed a 24-trial training block sorting the images (labeled as cisgender or

transgender) into cisgender or transgender categories. See Appendix A for stimuli and transgender target information.

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 preliminary training block. IATs followed the design recommended in Nosek, Greenwald, & Banaji (2007) and were scored by the *D* algorithm (Greenwald, Nosek, & Banaji, 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 milliseconds 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 towards 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 rights or freedom to transgender people ($\alpha = .87$; see 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 ($\alpha = .86$).

Table 1
Block Structure of the Image Transgender IAT

Block	Trials	Trial stimuli	Example Pairings
Training	24	Only images	Cisgender/Transgender (categories)
1	20	Only images	Cisgender/Transgender (categories)
2	20	Only words	Good words/Bad words (categories)
3	20	Words and images	Transgender People + Bad words/Cisgender People + Good words
4	40	Words and images	Transgender People + Bad words/Cisgender People + Good words
5	28	Only images	Transgender/Cisgender (categories)
6	20	Words and images	Cisgender People + Bad words/Transgender People + Good words
7	40	Words and images	Cisgender People + Bad words/Transgender People + Good words

Procedure

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

Results

We compared the image and text IATs on internal reliability, error rates in critical blocks, and overall *D* scores. We computed Cronbach's alpha (Cronbach, 1955) for each IAT by matching the 60 critical trials in blocks 3-4 with the 60 critical trials in blocks 6-7, then dividing these trials into three parcels of 20 trials (first 20 trials of blocks 3-4 and first 20 trials of blocks 6-7 into the first parcel, etc.) and computing *D* scores for each parcel. Both IATs exhibited acceptable (and comparable) internal reliability and error rates. The image IAT ($\alpha = .72$) was slightly more reliable than the text-based IAT ($\alpha = .70$). The image IAT ($M = 6.27\%$, $SD = 5.71$) and the text-based IAT ($M = 5.91\%$, $SD = 5.94$) had equally low error rates, $t(305) = 1.19$, $p = .234$, $d = .07$.

Both IATs found more positive implicit associations for cisgender versus transgender people on average. The image IAT ($M = .31, SD = .39$) produced larger effects than the text IAT ($M = .17, SD = .42$), $t(305) = 5.26, p < .001, d = .30$.

Finally, both IATs reliably correlated with self-reported warmth towards transgender people, relative preferences between cisgender and transgender people, transphobia, and support for transgender-related policies (all $|r|$'s $> .15$, all p 's $< .014$, see Table 2 for correlation matrix and descriptive statistics). There were no significant differences between the IATs in their correlations with warmth towards transgender people ($t(292) = -0.23, p = .818$), warmth towards 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-based IAT, $t(278) = 1.91, p = .057$.

Discussion

Two IATs assessing implicit attitudes towards transgender people – one using images of transgender and cisgender celebrities and one using words - showed more negative associations with transgender versus cisgender people and correlated with self-reported explicit attitudes towards transgender people and beliefs about their treatment. The IATs had comparable internal reliability and error rates, 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 strong evidence that the image-based IAT is an equal (if not better) measure of implicit transgender attitudes as compared to the text-based IAT.

Table 2
Descriptive Statistics and Correlations among Study 1 Measures (N = 260)

Measure	Mean	SD	1	2	3	4	5	6	7
1. Image IAT <i>D</i> -score	0.31	0.39	-	(.22, .44)	(-.09, .16)	(-.27, -.03)	(.13, .35)	(-.39, -.17)	(.15, .38)
2. Text IAT <i>D</i> -score	0.17	0.42	0.33	-	(-.07, .17)	(-.28, -.05)	(.12, .35)	(-.27, -.03)	(.11, .34)
3. Warmth for cisgender	5.27	1.34	*0.04	*0.05	-	(.21, .43)	(.17, .39)	(-.14, .10)	(-.03, .21)
4. Warmth for transgender	4.88	1.40	-0.15	-0.17	0.32	-	(-.57, -.39)	(.41, .59)	(-.68, -.53)
5. Relative preference	4.58	1.03	0.24	0.24	0.29	-0.49	-	(-.57, -.39)	(.49, .65)
6. Policy Advocacy	5.84	1.36	-0.29	-0.16	*-0.02	0.51	-0.48	-	(-.76, -.58)
7. Self-reported transphobia	2.89	1.27	0.27	0.22	*0.09	-0.61	0.57	-0.68	-

Note. * denotes a correlation where $p > .05$. All other correlations significant at $p < .05$.

The online supplement details two studies (Study S1 and S2; <https://osf.io/rcgdx/>) providing additional evidence of validity for the image-based transgender IAT. Study S1 ($N = 720$) demonstrated known-groups validity, with heterosexual participants exhibiting more negative implicit transgender associations than gay and lesbian participants ($d = .46, p = .008$), and replicated the reliable correlations between the IAT and explicit preference for cisgender versus transgender people ($r = .26, p < .001$), transphobia ($r = .32, p < .001$), and support for transgender-related policies ($r = -.19, p < .001$). Study S2 ($N = 415$) replicated these correlations (support for transgender-related policies, $r = -.16, p = .002$; transphobia, $r = .26, p < .001$) among a sample of participants reporting no explicit preference for cisgender over transgender people.

Study 2 had several goals. First, we sought to test the incremental predictive validity of implicit transgender attitudes in predicting other transgender-related beliefs and behaviors, including contact with transgender people and willingness to engage in romantic relationships, as well as gender-based beliefs more generally (gender essentialism, hostile and benevolent sexism). Second, we sought more statistically robust evidence that implicit transgender attitudes predict such outcomes beyond explicit transgender attitudes by relying on structural equation modeling analyses that properly account for measurement reliability, rather than linear regression analyses that may inflate false positive rates (Westfall & Yarkoni, 2016). Third, we tested whether implicit and explicit transgender attitudes are best conceived as a single construct, two independent constructs, or two distinct-but-related constructs. Finally, Study 2 was able to provide the first estimate of general implicit transgender attitudes among transgender people.

Study 2

Method

Participants

2185 volunteers ($M_{Age} = 32.4$, $SD = 13.0$; 72.7% White; 60.4% female; 69.6% US citizens) at Project Implicit 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 50 transgender participants with usable IAT data and at least 350 participants completing each outcome measure, which exceeds the minimum suggested sample size for SEM analyses (Kline, 2005). Due to delays in study replacement, the final sample was slightly larger.

Measures and Procedure

Participants completed the following measures in randomized order.

Implicit Transgender Attitudes. Participants completed the image IAT from Study 1 ($\alpha = .79$). For SEM analyses, the implicit construct was estimated by four indicators, calculated by dividing each IAT block into four bins and creating a D score for each bin ($\alpha = .84$). Participants were removed from analyses using the same criteria as Study 1 (2.5% of IAT scores).

Explicit Transgender Attitudes. Participants completed the relative explicit preference item and thermometer items from Study 1. Participants also completed two items indicating how much they liked cisgender and transgender people separately (1= “Strongly dislike”, 7= “Strongly like”). These additional items allowed for SEM analyses, as estimating latent constructs generally requires a minimum of three indicators (Bollen & Hoyle, 2012). 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 linear regression and correlational analyses, we calculated an aggregate explicit attitude variable by averaging these three standardized variables.²

Demographics. Participants completed a 14-item demographics questionnaire, including gender identity, age, race, ethnicity, and country of citizenship (all data available online). Two items assessed gender: participants first reported the sex they were assigned at birth (male or female), followed by their 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 if sex assigned at birth matched current gender identity. Participants were categorized as transgender if they either 1) 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 2) 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 nine outcome measures. Detailed wording and scoring information can be found in Appendix C:

1) **Support for four transgender-related policies** (16-items; adapted from Roberts, Ho, Rhodes, & Gelman, 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. Attitudes on each policy were strongly correlated (all r 's > .53), and thus combined in aggregate ($\alpha = .93$); higher values indicate more agreement with policies supportive of transgender people.

² Study 2 also included items regarding cisgender and transgender men and women. These items are available online but are not included in analyses.

- 2) **Past experience or willingness to have a romantic relationship** with a transgender person (5 items; $\alpha = .89$). Higher values indicated greater willingness or experience.
- 3) Previous or current contact with transgender people (4 items; $\alpha = .66$)³; higher values indicated more contact.
- 4) **Misconceptions about transgender people** (20 items; $\alpha = .94$; sample items: “Transgender people are confused about their sexuality,” “Transgender people are trying to trick others,” “Transgender people are confused about gender”); higher values indicate greater endorsement of misconceptions.
- 5) **Transgender Attitudes and Belief Scale** (TABS; Kanamori et al., 2017; 29 items, $\alpha = .96$; 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; 5 items, $\alpha = .80$, 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 ($\alpha = .92$) and Benevolent Sexism ($\alpha = .84$) subscales. Higher scores indicate greater sexism.

Two additional measures are available in the online dataset but not included in primary analyses (familiarity with IAT stimuli and feelings towards individuals of different sexual orientations).

³ This measure also included parallel items about contact with gay and bisexual people (available online).

Results

Cisgender and Transgender Participants

Study 2 allowed for the first comparison of implicit transgender attitudes between cisgender and transgender participants. Cisgender ($M = .57, SD = 1.06$) and transgender participants ($M = -.57, SD = 1.14$) both demonstrated explicit ingroup favoritism (all t 's > 3.84 , all p 's $< .001$, all d 's $> .50$; see online supplement) and reliably differed, $t(1918) = 8.15, p < .001, d = 1.04$. On the IAT, cisgender ($M = .19, SD = .45$) and transgender participants ($M = -.19, SD = .45$) both showed more positive implicit associations towards people from their own group (all t 's > 3.28 , all p 's $< .003$, all d 's $> .41$; see online supplement) and reliably differed, $t(1993) = 6.38, p < .001, d = .84$. See Table 3 for descriptive statistics.

Correlations Between Transgender Attitudes and Outcome Measures

IAT D scores and the aggregate explicit preference variable reliably correlated with each outcome measure in the expected direction (all $|r|$'s $> .291$, all p 's $< .001$). See Table 3 for descriptive statistics as well as correlations with IAT D scores and the aggregate explicit attitude variable.⁴ Compared to the IAT, the explicit measure was more strongly correlated with seven of the eight outcomes (see online supplement).

Tests of Incremental Predictive Validity

We first tested for incremental predictive validity of the implicit and explicit transgender attitude measures using simultaneous linear regression, predicting each outcome from participants' IAT D score and aggregate explicit attitude variable (see Table 4). Stronger implicit and explicit preferences for cisgender over transgender people predicted lower policy support, less relationship interest, less contact, more misconceptions, less positive beliefs and attitudes

⁴ The IAT and aggregate explicit preference variable were reliably correlated, $r = .363, p < .001$.

Table 3

Descriptive Statistics and Correlations (r) With IAT D Score and Explicit Preference for Study 2 Measures

Measure	Mean	SD	Correlation with IAT D	Correlation with Explicit Preference
1. Policy support (Range: 1-7)	5.69	1.23	-.405	-.598
2. Relationship interest (Range: 0-5)	1.79	1.91	-.403	-.527
3. Transgender contact (Range: 0-4)	1.71	1.21	-.303	-.396
4. Attitude and Belief Scale (Range: 1-5)	4.38	0.72	-.410	-.712
5. Transgender misconceptions (Range: 1-7)	2.03	1.03	.335	.590
6. Gender essentialism (Range: 1-7)	2.89	1.38	.330	.500
7. Benevolent sexism (Range: 1-6)	2.61	0.95	.290	.359
8. Hostile sexism (Range: 1-6)	2.30	1.10	.291	.514

Note. All correlations significant at $p < .001$.

Table 4
Coefficients and Test Statistics for Linear Regression Analyses in Study 2

Outcome	Explicit β	t	p	Implicit β	t	p	Model R^2
1. Policy support	-.52	-12.75	<.001	-.23	-5.60	<.001	.40
2. Relationship interest	-.44	-10.73	<.001	-.25	-6.08	<.001	.33
3. Transgender contact	-.33	-7.23	<.001	-.17	-3.79	<.001	.18
4. Attitude and Belief Scale	-.65	-17.76	<.001	-.18	-4.77	<.001	.53
5. Transgender misconceptions	.63	12.40	<.001	.13	2.95	.003	.36
6. Gender essentialism	.44	10.12	<.001	.19	4.36	<.001	.28
7. Benevolent sexism	.29	5.73	<.001	.18	3.61	<.001	.16
8. Hostile sexism	.47	9.88	<.001	.12	2.40	.017	.28

towards transgender people, greater gender essentialism, and increased hostile and benevolent sexism (all $|\beta|$'s > .11, all t 's > 2.40, all p 's < .017).

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

For each outcome measure, 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. Variances of the two latent factors were fixed at 1, in order to standardize, and the implicit and explicit latent factors were allowed to freely covary. See Figure 1 for a schematic

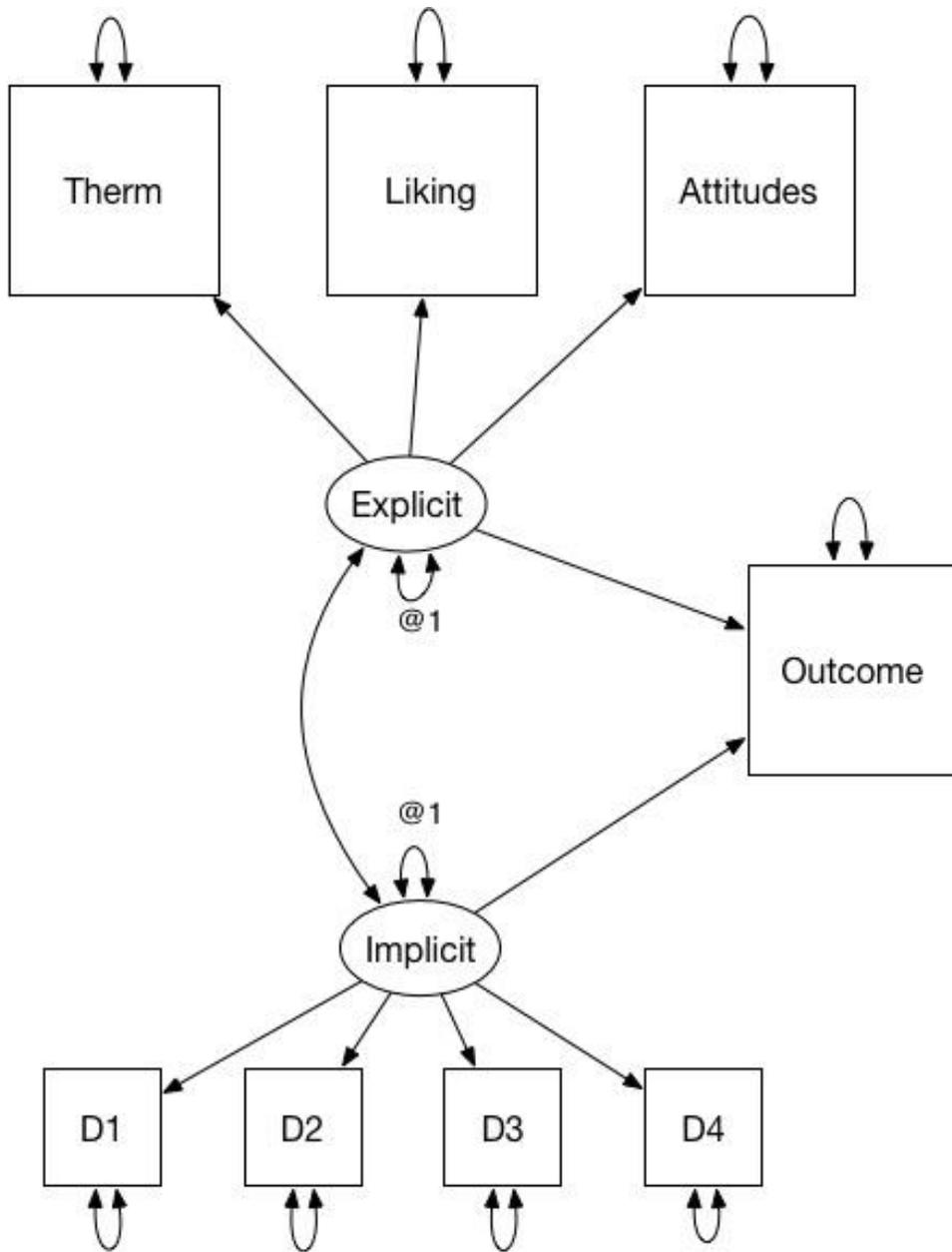


Figure 1. Schematic path diagram for the structural equation models assessing incremental validity in Study 2. Means for all manifest variables were estimated (not shown here).

path diagram. Evidence of incremental validity was present if removing the direct path between the implicit latent variable and the outcome measure significantly reduced model fit.

We found evidence for incremental validity of the implicit construct for five of the eight outcomes: transgender contact, transgender misconceptions, gender essentialism, benevolent

Table 5
Coefficients and Test Statistics for SEM Analyses in Study 2

Outcome	Full Model			Explicit-Only	Model Comparison		
	RMSEA	Explicit β	Implicit β	Model RMSEA	Δ df	Δ -2LL	<i>p</i>
1. Policy support	.17	-.65 ^a	.32 ^a	.034	1	-1122.07	1.00
2. Relationship interest	.16	-.78 ^a	.48 ^a	.037	1	-1002.93	1.00
3. Transgender contact	.032	-.46 [-.58, -.35]	-.13 [-.25, -.008]	.033	1	4.14	.036
4. Attitude and Belief Scale	.18	-.47 ^a	.14 ^a	.035	1	-1301.60	1.00
5. Transgender misconceptions	.027	.60 [.50, .71]	.12 [.011, .22]	.028	1	4.69	.030
6. Gender essentialism	.033	.76 [.62, .90]	.22 [.084, .35]	.034	1	10.06	.002
7. Benevolent sexism	.029	.27 [.17, .38]	.19 [.077, .31]	.032	1	10.47	.001
8. Hostile sexism	.030	.51 [.39, .63]	.15 [.028, .28]	.031	1	5.77	.016

Note. RMSEA = Root Mean Square of Approximation; -2LL = -2 Log Likelihood. Values in brackets are 95% confidence intervals
^aConfidence intervals could not be calculated.

Table 6
Model Fit Statistics for SEM Measurement Models in Study 2

Model	AIC	CFI	RMSEA	df	-2LL	Model Δ df	Comparison Δ -2LL	w/Model 1 <i>p</i>
Model 1: Related Constructs	13,836.08	.995	.033	15166	44,168.08	-	-	-
Model 2: Identical Constructs	15,071.57	.82	.20	15167	45,405.57	1	1,237.49	<.001
Model 3: Unrelated Constructs	14,126.89	.95	.10	15167	44,460.89	1	292.81	<.001

Note. AIC = Akaike Information Criterion; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation; -2LL = -2 Log Likelihood

sexism, and hostile sexism (all X^2 's > 4.14, all p 's < .036). SEM paths were in the same direction as in the regression analyses. See Table 5.

Tests of Construct Independence

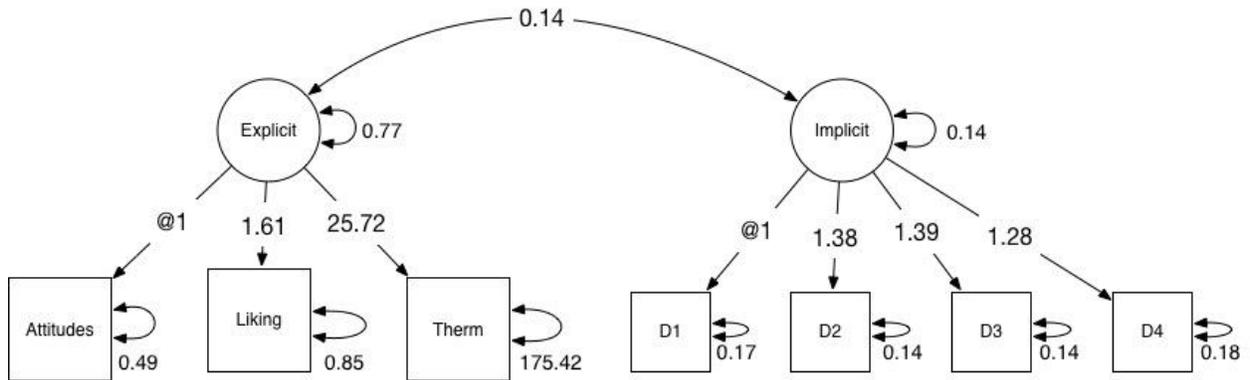
To assess whether implicit and explicit transgender attitudes are separable constructs, we examined the relationship between the implicit and explicit latent factors (e.g. Nosek & Smyth, 2007). We fit three nested structural equation models to Study 2 data (see Figure 2 for path diagrams), and found that a model allowing implicit and explicit transgender attitudes to be distinct but related constructs fit the data significantly better than a model which fixed them to one unitary construct, $X^2(1) = 1237.49$, $p < .001$, or a model which fixed them to be two wholly separate constructs, $X^2(1) = 292.81$, $p < .001$. See Table 6 for model fit statistics.

General Discussion

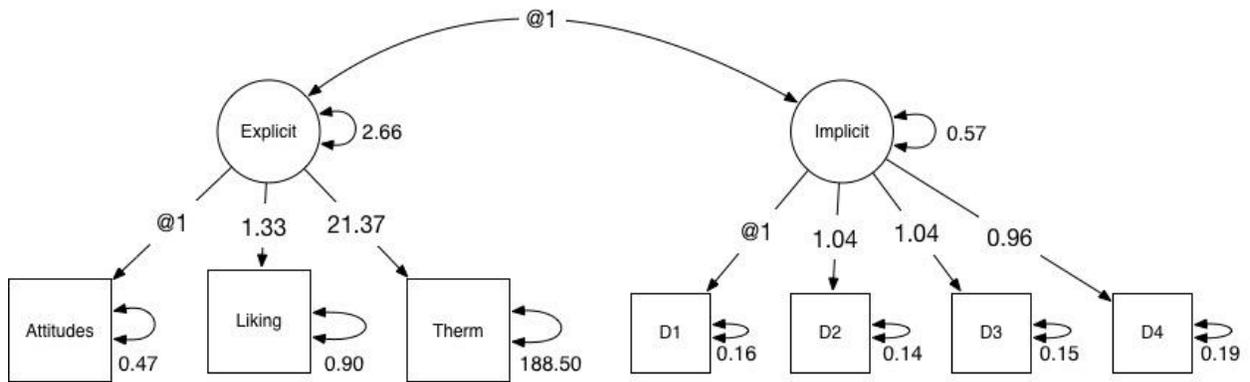
We developed a measure of implicit transgender attitudes, and found implicit and explicit transgender attitudes reflect distinct but related constructs. Implicit transgender attitudes were associated with meaningful outcomes, including transphobia, support for transgender-related policies, prior contact with transgender people, and willingness to engage in romantic relationships with transgender people, as well beliefs like hostile sexism and gender essentialism. Study 2 suggests that, after controlling for explicit attitudes, implicit transgender attitudes predicted contact with transgender people, belief in common misconceptions about transgender people, gender essentialism, and hostile and ambivalent sexism. These findings emphasize the importance of implicit assessments of transgender attitudes; implicit measures can provide relevant information that people may not be willing (or able) to self-report.

While implicit transgender attitudes did not reliably predict support for policies related to transgender treatment or interest in romantic relationships with transgender people, Study 2

Model 1: Related Constructs



Model 2: Identical Constructs



Model 3: Unrelated Constructs

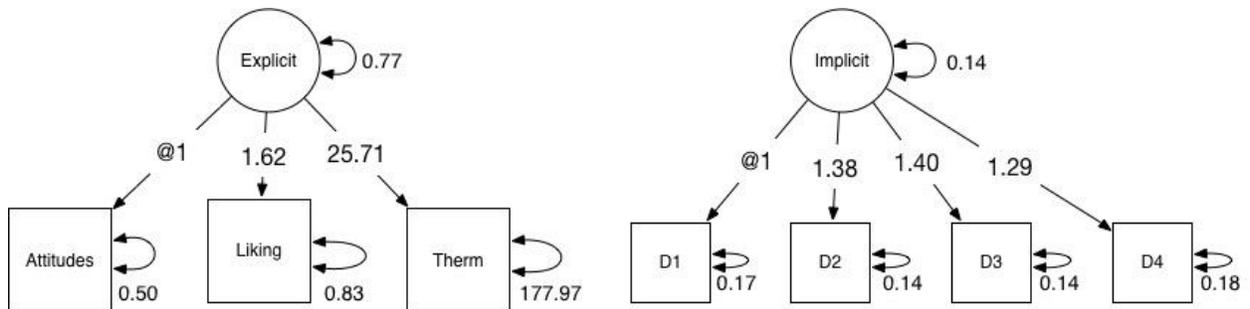


Figure 2. Path diagrams for the structural equation models testing construct independence in Study 2. Means for all manifest variables were estimated (not shown here).

results are noteworthy because they present one of the first uses of SEM to show evidence for (and against) the incremental predictive validity of implicit attitudes. The SEM analyses are

notable in that, for three outcomes, conclusions differed from linear regression analyses, which all found evidence of incremental predictive validity. These results highlight the difficulty in drawing comparisons with prior work that relied on linear regression analyses, as past conclusions might also change if measurement reliability were properly accounted for. The few existing tests of incremental predictive validity of implicit associations using SEM have likewise produced positive (Axt, Bar-Anan, & Vianello, 2018) and negative (Brick & Lai, 2018) results. The present work provides evidence for the incremental predictive validity of implicit attitudes for some outcomes, and we hope these studies spur additional investigations into when implicit attitudes do and do not predict relevant beliefs and behaviors.

While this work shows implicit transgender attitudes statistically predict relevant outcomes, such as contact with transgender people or belief in misconceptions about transgender people, 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, Lai et al. 2018). Thus, having established these correlational relationships, it is critical that subsequent work test whether implicit transgender attitudes have a causal effect on these outcomes. Such evidence would suggest that 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., towards “transgender people” as the focal category) among

transgender people. One noticeable result is that transgender participants showed implicit ingroup favoritism ($d = .424$) at levels nearly identical to their cisgender counterparts ($d = .415$). 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 notable but related exception is sexual orientation, which has shown consistent implicit in-group favoritism in lesbian- and gay-identified populations (Westgate et al., 2015). Further exploring the causes behind this variation in implicit ingroup favoritism among minority populations should be a focus of future work.

Transgender Attitudes and Gender Essentialism

Another noteworthy finding was the positive correlation between anti-transgender implicit attitudes and gender essentialism. This measure of essentialism assessed the belief that there are fundamental differences between genders, and that these differences should dictate the roles, occupations, or opportunities available to each gender (e.g., Smiler & Gelman, 2008). From this perspective, it is perhaps unsurprising that gender essentialism was positively correlated with more negative implicit and explicit attitudes towards transgender people, who may be viewed as threatening this rigid gender structure (Ching & Xu, 2018).

However, it is also possible that “gender essentialism” could be construed in a way more favorable towards transgender people. That is, endorsing “gender essentialism” as the belief that individuals are born with an “essential” gender identity (or lack thereof) not necessarily aligned with sex assigned at birth would likely correlate with more positive transgender attitudes (Roberts et al., 2017). For example, greater agreement with the TABS item “Whether a person is male or female depends upon whether they feel male or female” was associated with more positive transgender attitudes, both implicitly ($r = .33, p < .001$) and explicitly ($r = .57, p < .001$).

Subsequent research on this topic should further explore how different types of gender essentialist beliefs relate to attitudes and behaviors concerning transgender people.

Available Resources and Future Uses

We hope researchers will find this transgender IAT useful in studying the development of transgender attitudes and the causes or consequences of transphobia. To aid in that goal, we have made data and materials available, and have programmed an Inquisit version of the transgender IAT. These resources can be accessed at <http://bit.ly/2y6LJdp>.

One possible concern with the transgender IAT is its potential dependence on participants' familiarity with the transgender celebrities used as stimuli. It is important to note that past research suggests IAT category labels are far more important than the specific stimuli used (Dasgupta & Greenwald, 2001), and consistent with this work, Study 1 found that the image-based transgender IAT had similar internal reliability, error rates and predictive validity as a text-based IAT. In addition, a subset of participants ($N = 249$) in Study 2 rated their familiarity with each of the transgender celebrities. Participants who were not familiar with any of the transgender celebrities exhibited reliability on the IAT at levels comparable to participants who on average reported being at least "a little" familiar with each transgender celebrity (No familiarity $\alpha = .79$, A little familiarity $\alpha = .84$), and the two groups did not differ significantly in IAT error rates (No familiarity $M = .08$, $SD = .07$; A little familiarity $M = .07$, $SD = .06$; $t(247) = 1.75$, $p = .082$). While familiarity with the stimuli may be helpful, there is little evidence to suggest that such familiarity is required to achieve satisfactory measurement.

We anticipate that this measure of implicit transgender attitudes will assist researchers in understanding how such attitudes relate to other transgender-related beliefs or behaviors, as well as how implicit transgender attitudes change over time. Given evidence of changes in implicit

attitudes towards gay people (Westgate et al., 2015), similar changes in implicit attitudes towards transgender people may occur in the coming years. The IAT introduced here may also be useful to researchers and the public in raising awareness of transphobia. While the transgender community has been historically under-researched and under-represented in psychological literature, that is changing (Tompkins et al., 2015). Future research may contribute to greater awareness in addressing how implicit and explicit attitudes impact the daily lives of transgender people.

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Appendix A

Transgender and cisgender celebrities used as stimuli in the image-based transgender IAT

Category	Items
Cisgender celebrities	
Transgender celebrities	

Background information provided for transgender celebrity stimuli.

In this categorization task, you will sort images of both transgender and cisgender people. These are images of real people, some of whom you may know. To further familiarize yourself with these images, we provided a short description of each. This page contains the transgender images and the next page contains the cisgender images.

"Cisgender" refers to people who feel there is a match between the sex they were assigned at birth and the gender they feel themselves to be. "Transgender" refers to people who feel there is a mismatch between the sex they were assigned at birth and the gender they feel themselves to be.

Transgender Person	Name and Description
	Chaz Bono is a musician and actor.
	Chris Mosier is a triathlete.
	Laverne Cox is an actress.
	Caitlyn Jenner is a television personality.

Press the button below to learn about the cisgender images.

Continue

Appendix B

Transgender policy-related items used in Study 1, Studies S2-S2.

All responses made on a 1=Strongly Disagree to 7=Strongly Agree scale. All items presented in a randomized order. Aggregate score calculated by averaging all responses.

1. Transgender people should be able to use the bathroom of the gender they most closely identify with.
2. Transgender people should be able to easily obtain new official documents (driver's license, passports, etc.) after deciding to transition.
3. Transgender people working in offices with dress codes should be able to dress as the gender they most closely identify with.
4. Transgender people should be able to adopt children.
5. Health insurance should cover services needed by transgender people (hormones, surgery, etc.).

Appendix C

Outcome variables used in Study 2.

Policy Support

All responses made on a 1=Strongly Disagree to 7=Strongly Agree scale. Presentation of prompts was randomized, but order of items within prompts was fixed. Aggregate score calculated by averaging all responses. R = Reverse-scored item.

Prompt 2: North Carolina's General Assembly recently passed a law that directed all public schools, college campuses, and government agencies to require that every multiple-occupancy bathroom or changing facility (e.g., school restroom, locker room, changing room, or shower room) be used only by people based on their biological sex (i.e., the physical condition of being male or female, which is stated on a person's birth certificate). This law requires that transgender people use the bathroom that corresponds to the gender on their birth certificate.

Prompt 1, Item 1: I support this law. *R*

Prompt 1, Item 2: Every state should adopt a law like this. *R*

Prompt 1, Item 3: It is wrong for people to use a bathroom that doesn't correspond with their biological sex. *R*

Prompt 1, Item 4: Transgender people should be allowed to use any bathroom they feel comfortable with.

Prompt 2: The University of North Carolina's LGBTQ Task Force supports, provides, and fully funds counseling services that help transgender people understand their gender-related experiences and feel secure in their gender identity.

Prompt 2, Item 1: I support the mission of this Task Force.

Prompt 2, Item 2: Every university should have a Task Force like this.

Prompt 2, Item 3: It is wrong for university counselors to provide services that help transgender people. *R*

Prompt 2, Item 4: Government agencies should fund counseling services that promote the transgender community.

Prompt 3: The United States Department of Defense (DoD) recently announced a new policy stating that transgender people are allowed to serve openly in the United States military, and cannot be discharged solely for identifying as transgender. Current military personnel may transition to their preferred gender with the support of a military medical provider. After transitioning, military personnel must use berthing, bathroom, and shower facilities that correspond with their preferred gender, and meet their preferred gender's physical fitness standards for the military.

Prompt 3, Item 1: It is wrong for transgender people to serve in the military. *R*

Prompt 3, Item 2: I support this policy.

Prompt 3, Item 3: Every country's military should have a policy like this.

Prompt 3, Item 4: Transgender people should be allowed to serve in the military as their preferred gender.

Prompt 4: Illinois recently banned 'trans panic' as a legal defense in assault, manslaughter, and murder cases. Under the old law, defendants could argue that they engaged in sexual relations while unaware of the victim's gender identity, and that this later discovery induced a state of temporary insanity that made them legally not accountable for their actions. Under the new ban, defendants are no longer allowed to use the discovery of a sexual partner's undisclosed gender identity as a legal defense.

Prompt 4, Item 1: I support this legal ban.

Prompt 4, Item 2: Every state should ban legal defenses like this.

Prompt 4, Item 3: It is wrong for transgender people to have sexual relations without disclosing their gender identity. *R*

Prompt 4, Item 4: People should be allowed to use the discovery of a sexual partner's undisclosed gender identity as a legal defense for assault, manslaughter, or murder. *R*

Transgender Relationship Interest

All responses made on a 0=No, 1= Yes scale. Items were presented in a randomized order.

Aggregate score calculated by summing all five responses.

1. I am currently dating, or have dated a transgender person in the past.
2. I would be open to a romantic relationship with a transgender person.
3. I would go on a date with a transgender person.
4. I would be willing to engage in a sexual act with a transgender person.
5. I would be willing to marry a transgender person.

Transgender Contact

All responses made on a 0=No, 1= Yes scale. Items were presented in a randomized order.

Aggregate score calculated by summing all four responses.

1. Do you have a family member who is transgender?
2. Do you have a friend who is transgender?
3. Do you have friendly interactions with transgender people on a regular basis?
4. Have you ever met a transgender person?

Transgender Attitude and Belief Scale (TABS; Kanamori et al., 2017)

All responses made on a 1=Strongly Disagree to 5=Strongly Agree scale. Items were presented in a randomized order. Aggregate score calculated by averaging all responses. R = Reverse-scored item.

1. I would feel comfortable if my next-door neighbor was transgender.
2. I would find it highly objectionable to see a transgender person being teased or mistreated.
3. Whether a person is male or female depends strictly on their external sex-parts. *R*
4. Although most of humanity is male or female, there are also identities in between.
5. I would be comfortable being in a group of transgender individuals.
6. A person who is not sure about being male or female is mentally ill. *R*
7. I would be upset if someone I'd known for a long time revealed that they used to be another gender. *R*
8. If I knew someone was transgender, I would tend to avoid that person. *R*
9. If I knew someone was transgender, I would still be open to forming a friendship with that person.
10. I would be comfortable working for a company that welcomes transgender individuals.
11. All adults should identify as either male or female. *R*
12. Transgender individuals are valuable human beings regardless of how I feel about transgenderism.
13. A child born with ambiguous sex-parts should be assigned to be either male or female. *R*

14. A person does not have to be clearly male or female to be normal and healthy.
15. Humanity is only male or female; there is nothing in between. *R*
16. If a transgender person asked to be my housemate, I would want to decline. *R*
17. If you are born male, nothing you do will change that. *R*
18. I would feel comfortable having a transgender person into my home for a meal.
19. If my child brought home a transgender friend, I would be comfortable having that person into my home.
20. I would feel uncomfortable working closely with a transgender person in my workplace. *R*
21. Whether a person is male or female depends upon whether they feel male or female.
22. Transgender individuals should have the same access to housing as any other person
23. If a transgender person identifies as female, she should have the right to marry a man.
24. I would be uncomfortable if my boss was transgender. *R*
25. If someone I knew revealed to me that they were transgender, I would probably no longer be as close to that person. *R*
26. Transgender individuals should be treated with the same respect and dignity as any other person.
27. Transgender individuals are human beings with their own struggles, just like the rest of us.
28. I would feel uncomfortable finding out that I was alone with a transgender person. *R*
29. If I found out my doctor was transgender, I would want to seek another doctor. *R*

Transgender Misconceptions

All responses made on a 1=Strongly Disagree to 5=Strongly Agree scale. Items were presented in a randomized order. Aggregate score calculated by averaging all responses.

1. Transgender people are trying to trick others.
2. Transgender people are trying to hide their gender from others for personal gain.
3. Transgender people are confused about their sexuality.
4. Transgender people are secretly lesbian, gay, or bisexual.
5. Transgender people are trapped in the wrong body.
6. All transgender people must medically transition through hormone therapy or surgery.
7. Transgender people are confused about gender.
8. Transgender people who identify as male or female are not “real” men or women.
9. Sex-reassignment surgery is what makes a person transgender.
10. Wanting to wear clothes typical of the opposite sex makes a person transgender.
11. Cross-dressers are transgender.
12. Drag queens (and drag kings) are transgender.
13. Transgender people are mentally ill.
14. Transgender people can be “fixed” through therapy.
15. Transgender people are unstable or flaky.
16. Transgender people have weak morals.
17. Transgender people are a danger to children.
18. Transgender people are hypersexual.
19. Most transgender people are sex workers.

20. Most transgender people are HIV+.

Gender Essentialism (Hettinger, 2014)

All responses made on a 1=Strongly Disagree to 7=Strongly Agree scale. Items were presented in a randomized order. Aggregate score calculated by averaging all responses.

1. Personality differences between men and women cannot be changed, because they are caused by biological factors such as genes and hormones.
2. Just knowing whether someone is male or female can tell you a lot about that person.
3. Masculinity and femininity are mutually exclusive categories, and each person either belongs to one or the other.
4. Under the surface, people are essentially very similar to others of their own gender.
5. Masculinity and femininity are concepts that have endured in basically the same form over time and across cultures.

Ambivalent Sexism (Glick & Fiske, 1996)

All responses made on a 1=Strongly disagree to 6=Agree strongly scale. Items were presented in a randomized order. Aggregate score calculated by averaging all responses. B= Benevolent Sexism item, H= Hostile Sexism item. R = Reverse-scored item.

1. No matter how accomplished he is, a man is not truly complete as a person unless he has the love of a woman. *B*
2. Many women are actually seeking special favors, such as hiring policies that favor them over men, under the guise of asking for "equality." *H*
3. In a disaster, women ought not necessarily to be rescued before men. *B,R*
4. Most women interpret innocent remarks or acts as being sexist. *H*
5. Women are too easily offended. *H*

6. People are often truly happy in life without being romantically involved with a member of the other sex. *B,R*
7. Feminists are not seeking for women to have more power than men. *H,R*
8. Many women have a quality of purity that few men possess. *B*
9. Women should be cherished and protected by men. *B*
10. Most women fail to appreciate fully all that men do for them. *H*
11. Women seek to gain power by getting control over men. *H*
12. Every man ought to have a woman whom he adores. *B*
13. Men are complete without women. *B,R*
14. Women exaggerate problems they have at work. *H*
15. Once a woman gets a man to commit to her, she usually tries to put him on a tight leash. *H*
16. When women lose to men in a fair competition, they typically complain about being discriminated against. *H*
17. A good woman should be set on a pedestal by her man. *B*
18. There are actually very few women who get a kick out of teasing men by seeming sexually available and then refusing male advances. *H,R*
19. Women, compared to men, tend to have a superior moral sensibility. *B*
20. Men should be willing to sacrifice their own well-being in order to provide financially for the women in their lives. *B*
21. Feminists are making entirely reasonable demands of men. *H,R*
22. Women, as compared to men, tend to have a more refined sense of culture and good taste. *B*