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TARGET EFFECTS

DELIBERATE CHANGES TO GENDERED BODY MOTION INFLUENCE BASIC SOCIAL PERCEPTIONS

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Perceivers use gendered body motion to categorize others' social identities, and these categorizations carry important consequences ranging from mate selection to prejudice. In light of such consequences, people might be motivated to control others' perceptions of their social identities by altering gendered aspects of their gait. However, it is unclear whether such deliberate body motions are sufficient to alter basic social perceptions. The authors examined sex (Study 1) and sexual orientation categorizations (Study 2) based upon point-light displays of targets who moved with self-paced, accelerated, deliberately gender-typical, and deliberately gender-atypical gaits. Categorization accuracy varied by walk condition and target characteristics, such that lesbian/gay and female targets were systematically miscategorized when altering gendered aspects of their gait. These findings demonstrate that deliberately gendered gaits can indeed alter basic social perceptions, raising new questions about the malleability of gait and the role of targets' motivations in social vision.

Social categorization is a complex task that incorporates low-level visual features originating in the target of perception (Brebner, Martin, & Macrae, 2009; Maclin & Malpass, 2003), top-down inferential biases originating in the perceiver (Cohen, 1981; Johnson & Carpinella, 2012), and contextual factors reflecting the social ecology in which a percept occurs (McArthur & Baron, 1983). While social

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vision scholars have begun to document these diverse factors influencing person perception, many topics remain unclear. For instance, researchers have often acknowledged that in addition to the physical determinants of visual cues (e.g., biomechanical determinants of walk motions), targets may deliberately present themselves in ways that elicit socially desirable categorizations (see Murray, Kory, & Sepic, 1970). A clear example of such deliberate self-presentation is a gay man who intentionally alters his facial expressions, mode of dress, and body motion in order to avoid prejudice by compelling straight categorizations. While such intentional presentations may be common, our knowledge of their effects on social categorization is limited at best. In the current studies, we examined whether deliberate changes to gendered body motion are sufficient to alter basic perceptions of one's sex and sexual orientation.

PERCEIVING SEX AND SEXUAL ORIENTATION

People reach important conclusions about others within mere seconds of seeing them. For example, perceivers achieve accurate sex categorizations from brief glimpses of degraded visual stimuli (Pollick, Kay, Heim, & Stringer, 2005), and they can accurately judge targets' sexual orientations within 50 ms of visual exposure (Rule & Ambady, 2008). Although expedient, these perceptions carry important consequences. Categorizing a person as male or female affects the way the individual is treated by potential mates (Buss, 1989), employers (Heilman, Wallen, Fuchs, & Tamkins, 2004), and even attackers (Gunns, Johnston, & Hudson, 2002). Categorizing a person as lesbian/gay can result in prejudice, job loss, or violence (Herek, Cogan, & Gillis, 2002). In light of these consequences, people may be highly motivated to manage others' perceptions of their social identities (DePaulo, 1992).

One way in which people could manage others' social perceptions is by deliberately modifying the visible cues that inform specific categorizations. For example, altering the gender typicality of one's body movements is likely to have broad implications for perceptions of sex and sexual orientation because gendered cues are central to these judgments. Indeed, previous research has indicated that perceivers tend to categorize targets who walk in a feminine manner as women and those who walk in a masculine manner as men (Johnson & Tassinary, 2005). Gendered cues inform sexual orientation categorizations in a similar fashion: Perceivers tend to categorize targets who walk in a gender-typical fashion (masculine men) as straight, but they categorize those who walk in a gender-atypical fashion (feminine men) as gay (Johnson, Gill, Reichman, & Tassinary, 2007). Because gendered body motions are central to both sex and sexual orientation categorizations, targets who deliberately alter gendered aspects of their gait may influence others' perceptions of these social identities.

Despite theoretical rationale to believe that deliberately gendered body motions may alter social perceptions, existing research on this topic is sparse and mixed. One early study found that deliberately gendered walk motions did not affect basic social perceptions: People who were instructed to move like members of the opposite sex successfully manipulated their gaits, but observers readily identified these motions as deceptive (Runeson & Frykholm, 1983). Other studies found opposite effects. For instance, in early work using point-light displays, increasing a target's walking speed—a change that likely impaired self-presentation efforts—

significantly altered sex categorizations. Specifically, increased walking speeds compromised sex categorization accuracy for male targets but improved categorization accuracy for female targets (Kozlowski & Cutting, 1977). More recent studies demonstrated that gay men and lesbians were able to conceal their sexual orientation with some degree of success by altering their visible behaviors (Sylva, Rieger, Linsenmeier, & Bailey, 2010). Thus, while some studies have indicated that deliberate changes to body motion do not alter social perceptions, others have provided suggestive evidence that such changes may indeed affect social perceptions.

THE CURRENT RESEARCH

The literature on perceptual ramifications of intentionally gendered body motion is limited in several respects. First, while researchers have often acknowledged the potential importance of motivated body movements for social perception (Murray et al., 1970), few studies have explored this topic directly, and their results offer conflicting conclusions. Furthermore, most studies in this area have tested the implications of modified walk motions on judgments of biological sex. The few studies that have explored perceptions of sexual orientation have investigated broad measures of visible behavior (e.g., Sylva et al., 2010), precluding inferences about the specific role of deliberately gendered gaits in diverse types of social perception. Finally, while a few previous studies have explored main effects of intentional body motion on social perceptions, intentions may interact with target characteristics to predict social categorizations. That is, some people may be more able to manage social perceptions by altering their gait than are others, but extant data do not speak to this point. The current research simultaneously addressed these gaps in the literature by testing the effect of deliberately gendered body motions on multiple social perceptions (e.g., sex and sexual orientation) for individuals belonging to various social groups (e.g., gay/lesbian and straight; male and female).

Overall, we predicted that deliberate changes to gendered walk motions would alter the related perceptions of sex and sexual orientation. In Study 1, we examined sex categorizations of point-light displays that depicted people walking in four ways: self-paced, accelerated, deliberately gender-typical, and deliberately gender-atypical. We predicted that sex categorization accuracy would be relatively high in the self-paced condition, but that accuracy would decline in the accelerated condition, when walkers had less control over their movement. Furthermore, we predicted that accuracy would increase when walkers enacted gender-typical gaits but decrease when walkers enacted gender-atypical gaits. Finally, because lesbian/gay individuals may walk in more gender-atypical ways to begin with (Johnson et al., 2007) or may have more experience altering their gait to manage social perceptions (Pachankis, 2007), we expected that they would be more likely than straight targets to have their sex miscategorized, especially when enacting deliberately gender-atypical gaits.

In Study 2, we examined sexual orientation categorizations in an identical paradigm. We predicted that sexual orientation categorizations would be most accurate for targets with self-paced gaits, but that accuracy would decrease for accelerated or deliberately gendered gaits. We expected target sex to moderate this effect, such that women would be more likely to have their sexual orientation miscategorized than would men, as previous research suggests that body motions provide stron-

ger cues to male sexual orientation relative to female sexual orientation (Johnson et al., 2007). Collectively, these studies probe the perceptual ramifications of intentionally gendered body motions, providing new information about the role of targets' motivations in social perceptions based on biological motion.

In line with recent recommendations (Simmons, Nelson, & Simonsohn, 2011), we report how we determined our sample size and all data exclusions (i.e., none), manipulations, and measures for each study.

STUDY 1

In Study 1, we tested whether deliberate changes to gendered body motions altered sex categorization accuracy, and whether lesbian/gay individuals were more likely than straight individuals to have their sex miscategorized upon altering their gaits.

METHOD

Participants. Over a prespecified period of 3 weeks, 160 undergraduates (98 women) participated in exchange for course credit.

Stimuli. Stimuli included 64 point-light displays that varied between target by sex and sexual orientation (8 men—4 gay, 4 straight; 8 women—4 lesbian, 4 straight) and within target by walk condition. Targets walked on a treadmill in four different ways, including (a) self-paced, (b) accelerated (+.3 mph), (c) gender-typical (e.g., men walking in a masculine manner), and (d) gender-atypical (e.g., men walking in a feminine manner). Each walk condition was recorded using three-dimensional motion capture (Optotrak 3020, Northern Digital Instruments). We transformed the spatial location of major body landmarks (head, shoulders, elbows, wrists, hips, knees, and feet) for the first 10 s of each video into a point-light display using customized software.

Procedure. Stimuli were presented randomly in two blocks on Macintosh computers. In the first block, participants categorized each target's sex using keys labeled male and female. In the second block, participants judged each target's gender using a 9-point scale ranging from masculine to feminine. The proportion of male to female targets was unspecified, and sexual orientation was never mentioned. After completing all judgments, participants indicated their own sex before being debriefed.

RESULTS

Because our hypotheses involve the effect of deliberately gendered walk motions on sex categorization accuracy, we first aimed to replicate previous work demonstrating the central role of perceived gender in sex categorizations. Next, we tested whether the accuracy of sex categorizations varied as a function of Walk Condition and Sexual Orientation. We conducted these first two analyses using generalized estimating equations (GEEs), which are multilevel regression models that account

for within-subject dependencies in data (Zeger & Liang, 1986). Target Sex and Sexual Orientation were effect coded (*male* = −0.5, *female* = 0.5; *straight* = −0.5, *lesbian/gay* = 0.5), Walk Condition was dummy coded, and Accuracy was coded dichotomously (0 = *inaccurate,* 1 = *accurate*).[1] Finally, we explored perceivers' sensitivity to gendered walk motions while controlling for response biases with signal detection analyses (Stanislaw & Todorov, 1999).

Preliminary Analyses

Prior research using animated stimuli found that sex categories were inferred from gendered walk motions (Johnson & Tassinary, 2005). To replicate this finding among real targets, we regressed Perceived Sex onto Perceived Gender. As expected, these factors were strongly related, $B = 0.48$, $SE = .02$, $z = 27.79$, $p < .0001$, such that each *SD* increase in perceived gender (i.e., a more feminine rating) made female categorizations nearly three times more likely, OR = 2.9028.

Next, we examined whether gendered perceptions varied as a function of target sex and sexual orientation by regressing Perceived Gender onto Target Sex, Target Sexual Orientation, and their interaction. Perceivers judged women to be more feminine than men (*M*s = 5.826 and 4.121, respectively), $B = 1.71$, $SE = .05$, $z = 33.92$, $p < .0001$, and lesbian/gay targets to be more feminine than straight targets (*M*s = 5.09 and 4.85, respectively), $B = 0.24$, $SE = .03$, $z = 8.13$, $p < .0001$. These effects were qualified by the expected two-way interaction, $B = -2.55$, $SE = .08$, $z = -31.69$, $p < .0001$. Gay men were perceived as more feminine than straight men (*M*s = 4.84 and 3.33, respectively), simple $B = 1.52$, $SE = .05$, $z = 28.13$, $p < .0001$, whereas lesbians were perceived as less feminine than straight women (*M*s = 5.27 and 6.31, respectively), simple $B = -1.03$, $SE = .05$, $z = -22.46$, $p < .0001$.

Thus, our preliminary results replicated previous findings about the heuristic role of perceived gender in sex categorizations of real people (Johnson & Tassinary, 2005). Furthermore, they indicated that perceptions of gendered body motion vary as a function of target sexual orientation (Johnson et al., 2007). Collectively, these findings add to a growing literature demonstrating that targets' personal characteristics may affect the inferences that observers draw from body motion cues.

Sex Categorization Accuracy and Sensitivity

We used two complementary approaches to test our primary hypotheses about the effect of intentionally gendered walk motions on sex categorizations. First, we used perceivers as the unit of analysis to examine how categorization accuracy varied by target characteristics (i.e., sexual orientation) and gait intentions (i.e., walk condition). Next, we corroborated these findings using signal detection analyses to test observers' overall sensitivity to gendered body motions while controlling for response biases. Together, these analyses highlight not only the basic accuracy of perceivers' sex categorizations, but also their sensitivity and bias to visual cues of a target's sex category.

1. We initially included Participant Sex as a predictor in all analyses, but only one effect was significant: Men's sex categorizations were more accurate than women's, $B = -0.11$, $SE = .05$, $z = -2.03$, $p = .04$. Participant Sex was subsequently dropped from all analyses.

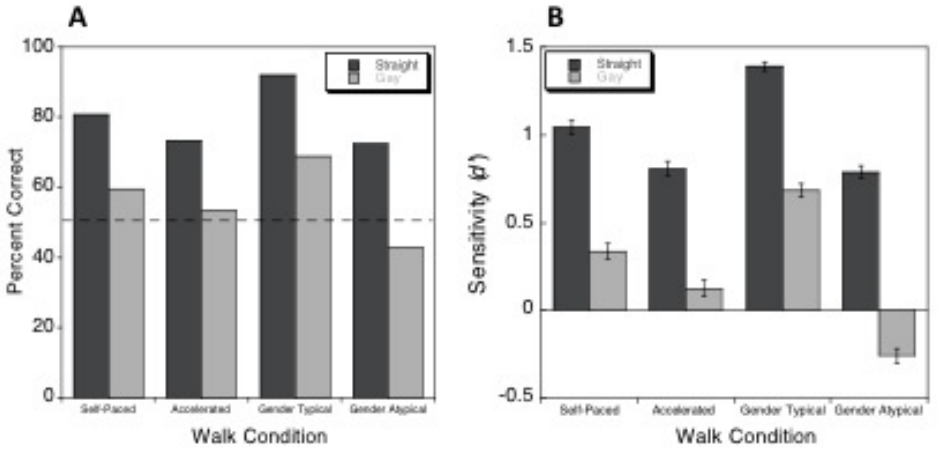

FIGURE 1. Percent of correct sex categorizations (A) and mean sensitivity to sex cues in body motions (B) as a function of target sexual orientation and walk condition in Study 1. Error bars depict standard errors around each mean.

Accuracy. To explore basic accuracy rates for sex categorizations, we computed the proportion of correct categorizations within each participant. Overall, accuracy was above chance and reached levels that are typical for perceptions of point-light displays (Pollick et al., 2005; M = 67.89% correct), $t(156) = 122.28$, $p < .0001$. To determine how personal characteristics affected sex categorization accuracy, we regressed Accuracy onto Target Sexual Orientation, Walk Condition, and their interaction. Sex categorizations were more accurate for straight relative to lesbian/gay targets (Ms = 81.16% and 56.40%), $\chi^2(1) = 128.87$, $p < .0001$, and accuracy varied by Walk Condition, $\chi^2(3) = 114.32$, $p < .0001$. Planned contrasts revealed that sex judgments of self-paced walks were more accurate (M = 71.31%) than judgments of accelerated (M = 64.02%) or gender-atypical walks (M = 58.35%), Bs = −.33 and −.57, SEs = .06 and .06, zs = −5.72 and −9.77, respectively, ps < .0001. However, sex judgments of self-paced walks were less accurate than judgments of gender-typical walks (M = 83.37%), B = .70, SE = .07, z = 9.42, $p < .0001$. Importantly, the hypothesized interaction between Sexual Orientation and Walk Condition was significant, $\chi^2(3) = 38.57$, $p < .0001$ (Figure 1A). The effect of Sexual Orientation (i.e., higher accuracy categorizing the sex of straight targets) was stronger for judgments of self-paced walks than for gender-typical or gender-atypical walks, simple Bs = −.57 and −.20, SEs = .12 and .10, zs = −4.67 and −1.95, ps < .0001 and .0513, respectively. These findings indicate that target sexual orientation and deliberate attempts to change body movement interactively determined the accuracy of sex categorizations.

Sensitivity. We conducted signal detection analyses to further probe perceivers' sensitivity to gendered body motions. We coded correct female categorizations as hits and correct male categorizations as correct rejections, computing sensitivity (d') using standard algorithms (Stanislaw & Todorov, 1999). Overall, d' was significantly greater than 0 (Table 1), suggesting that perceivers were sensitive to sex cues in body motions, $t(156) = 30.84$, $p < .0001$.

We next examined whether sensitivity varied as a function of target characteristics and deliberately gendered gaits using a 2 (Sexual Orientation: straight,

TABLE 1. Parameters for Signal Detection Analyses, Study 1

	Hits(%)	Misses(%)	C.R.(%)	F.A.(%)	$M_{d'}$
Gay Targets					
Self-Paced	60.35	39.65	58.60	41.40	0.33**
Accelerated	47.77	52.23	59.08	40.92	0.13*
Gender-Typical	67.52	32.48	70.38	29.62	0.68**
Gender-Atypical	49.04	50.96	36.62	63.38	–0.26**
Overall	56.17	43.83	56.17	43.83	0.22**
Straight Targets					
Self-Paced	75.16	24.84	86.46	13.54	1.05**
Accelerated	67.36	32.64	79.46	20.54	0.81**
Gender-Typical	91.56	8.44	92.20	7.80	1.39**
Gender-Atypical	69.42	30.57	75.32	24.68	0.79**
Overall	75.88	24.12	83.36	16.64	1.01**
Overall	66.02	33.98	69.77	30.23	0.62**

Note. *$p < .01$, **$p < .001$.

lesbian/gay) × 4 (Walk Condition: self-paced, accelerated, gender typical, gender atypical) repeated-measures ANOVA. As expected, sensitivity was higher for judgments of straight relative to lesbian/gay targets, $F(1, 156) = 679.03$, $p < .0001$, $\eta_P^2 = .81$, and sensitivity varied by Walk Condition, $F(3, 468) = 137.08$, $p < .0001$, $\eta_P^2 = .47$. Relative to self-paced walks, observers were more sensitive to gendered cues in deliberately gender-typical walks, $F(1, 156) = 90.53$, $p < .0001$, $\eta_P^2 = .37$, but less sensitive to cues in accelerated or deliberately gender-atypical walks, Fs(1, 156) = 28.23 and 106.18, ps < .0001, $\eta_P^2 = .15$ and .41, respectively.

These effects were qualified by a two-way interaction between Walk Condition and Target Sexual Orientation, $F(2.84, 443.16) = 12.26$, $p < .0001$, $\eta_P^2 = .07$ (Huynh-Feldt corrected for sphericity). (All pairwise comparisons appear in Tables 2 and 3.) Planned contrasts revealed that observers were more sensitive to gendered gaits among straight targets than among lesbian/gay targets, though the magnitude of this effect differed across walk conditions (Figure 1B). Specifically, the effect of sexual orientation was strongest for gender-atypical walks, contrast = 1.05, $SE = .05$, $F(1, 156) = 404.51$, $p < .0001$. Thus, perceivers were less accurate when categorizing the sex of lesbian/gay targets relative to straight targets, especially when they enacted gender-atypical gaits. Consistent with this interpretation, sensitivity was above chance for all but one cell (Table 1): Among lesbian/gay targets with deliberately gender-atypical gaits, sensitivity fell significantly below 0 ($M_{d'} = -0.16$), $t(156) = -5.85$, $p < .0001$. Because our study employed a two alternative forced-choice design, this negative d' indicates that perceivers systematically miscategorized the sex of lesbian/gay targets who enacted gender-atypical gaits.

DISCUSSION

Previous studies estimated a remarkable 71% accuracy for sex categorizations of point-light defined walk motions (Pollick et al., 2005). Accuracy of sex categoriza-

TABLE 2. Contrasts Comparing Sensitivity (d') Within Each Walk Condition by Target Sexual Orientation (Gay/Lesbian vs. Straight Target) in Study 1

Walk Condition	Contrast Value (Ψ)	*SE*	*F*	*P*
Self-Paced	0.71	.06	166.06	<.0001
Accelerated	0.68	.06	129.27	<.0001
Gender-Typical	0.71	.04	301.18	<.0001
Gender-Atypical	1.05	.05	404.51	<.0001

tions for self-paced walks was nearly identical in our study. When we instructed targets to move in a gender-typical fashion, accuracy improved, even though it was already quite high. When we accelerated targets' walking speeds and instructed them to move in a gender-atypical fashion, accuracy decreased but remained above chance. Most intriguingly, accuracy fell significantly below chance for lesbian/gay targets who deliberately walked in gender-atypical ways. These findings indicate that intentional changes to gendered body motion can affect basic social perceptions, although some people (i.e., lesbian/gay targets) may enact gendered gaits more convincingly than others, resulting in systematic miscategorizations of the most basic social identities.

STUDY 2

In Study 2, we aimed to extend the findings from Study 1 to another social categorization—sexual orientation. Prior research using animations and dynamic figural outlines revealed that the gendered motion cues guiding sex categorizations also inform sexual orientation categorizations (Johnson et al., 2007). Our first goal in Study 2 was to extend these findings by testing whether observers use gendered body motions to judge sexual orientation when those motions are isolated in point-light displays. Additionally, we tested whether deliberate changes to gendered body motion affected sexual orientation categorizations, and whether target characteristics moderated this effect such that women would be more likely than men to have their sexual orientation miscategorized after altering gendered aspects of their gait.

METHOD

Participants. Over a prespecified period of 2 weeks, 54 undergraduates (37 women, 14 men, 3 unreported) participated in exchange for course credit. Four men identified as gay; all others identified as straight.

Stimuli. Stimuli were the same point-light displays used in Study 1.

Procedure. Stimuli were presented randomly in three blocks on Macintosh computers. First, participants categorized target sex using keys labeled male and female. Then they judged target gender using a 9-point scale ranging from masculine to feminine. Finally, participants categorized target sexual orientation using keys labeled lesbian/gay and straight. The distribution of male to female and lesbian/gay to straight targets was unspecified, and sexual orientation was not mentioned

TABLE 3. Contrasts Comparing Sensitivity (d') Across Walk Conditions for Straight and Gay Targets in Study 1

Walk Conditions		Contrast Value (Ψ)	*SE*	*F*	*p*
Straight Targets					
Self-Paced					
	Accelerated	.23	.05	22.36	<.0001
	Typical	–.35	.04	76.72	<.0001
	Atypical	.26	.05	29.01	<.0001
Accelerated					
	Typical	–.59	.05	158.17	<.0001
	Atypical	.02	.05	0.15	.6956
Typical					
	Atypical	.61	.04	203.73	<.0001
Gay Targets					
Self-Paced					
	Accelerated	.21	.07	10.24	.0017
	Typical	–.34	.06	39.07	<.0001
	Atypical	.60	.06	95.50	<.0001
Accelerated					
	Typical	–.56	.06	86.31	<.0001
	Atypical	.38	.06	43.91	<.0001
Typical					
	Atypical	.94	.06	277.62	<.0001

until the final block. After completing all judgments, participants indicated their own sex and sexual orientation before being debriefed.

RESULTS

Our analytic plan was similar to Study 1 with two exceptions. First, it is important to note that gender *typicality* (i.e., masculine men, feminine women) drives sexual orientation perceptions rather than gender per se (i.e., masculinity, femininity; Johnson et al., 2007). To account for this fact, we included interactions between Target Sex and Perceived Gender in our GEE analyses. Second, Study 1 tested the moderating effect of target sexual orientation on sex categorizations. Study 2 tested the complementary hypothesis—namely, the moderating effect of Target Sex on Sexual Orientation categorizations. As before, Target Sex, Sexual Orientation, and Perceived Sex were effect-coded (*male* = –0.5, *female* = 0.5; *straight* = –0.5, *lesbian/gay* = 0.5), Walk Condition was dummy-coded, and Accuracy was coded dichotomously (0 = *inaccurate,* 1 = *accurate*).[2]

2. We initially included Participant Sex as a factor in all analyses, but only one effect was significant: Women had higher accuracy categorizing sexual orientation than men, $B = 0.19$, $SE = .08$, $z = 2.25$, $p = .02$. Participant Sex was subsequently dropped from all analyses.

TABLE 4. Parameters for Signal Detection Analyses, Study 2

	Hits(%)	Misses(%)	C.R.(%)	F.A.(%)	$M_{d'}$
Male Targets					
Self-Paced	27.31	72.69	87.91	12.09	0.24**
Accelerated	31.16	68.37	89.81	10.19	0.34**
Gender-Typical	28.37	71.63	88.43	11.57	0.26**
Gender-Atypical	54.67	45.33	72.43	27.57	0.47**
Overall	35.38	64.51	84.65	15.36	0.33**
Female Targets					
Self-Paced	38.68	61.32	46.98	53.02	−0.24*
Accelerated	31.16	68.84	46.30	53.70	−0.40**
Gender-Typical	60.00	40.00	22.79	77.21	−0.30**
Gender-Atypical	38.14	61.86	44.65	55.35	−0.31**
Overall	42.00	58.01	40.18	59.82	−0.31**
Overall	38.69	61.26	62.41	37.59	0.01

Note. *$p < .01$, **$p < .001$.

Preliminary Analyses

We first sought to test whether gendered walk motions inform sexual orientation categorizations based upon point-light displays by regressing Perceived Sexual Orientation onto Perceived Gender, Perceived Sex, and their interaction. Overall, participants were more likely to categorize targets as lesbian/gay when they judged them to be female, $B = 0.87$, $SE = .09$, $z = 9.13$, $p < .0001$, and when they judged them to be feminine, $B = 0.30$, $SE = .003$, $z = 8.90$, $p < .0001$. However, these effects were qualified by the expected two-way interaction, $B = -0.07$, $SE = .04$, $z = -2.03$, $p = .0428$. Among targets categorized as male, those perceived to be feminine were more likely to be categorized as gay, simple $B = 0.33$, $SE = .04$, $z = 8.77$, $p < .0001$. Among targets categorized as female, those perceived to be feminine were also more likely to be categorized as gay, although this trend was less pronounced than for men, simple $B = 0.26$, $SE = .04$, $z = 6.98$, $p < .0001$. These results corroborate earlier findings that perceivers use the gender-atypical walk motions as a heuristic for assessing male sexual orientation but not female sexual orientation (Johnson et al., 2007).

Sexual Orientation Categorization Accuracy and Sensitivity

As in Study 1, we used complementary approaches to examine our primary questions about sexual orientation categorizations as a function of deliberately gendered walk motion. First, we examined accuracy as a function of Target Sex, Perceived Gender, and Walk Condition. We then used signal detection analyses to determine how sensitivity to gendered cues varied as a function of these characteristics while controlling for response biases.

Accuracy. To explore basic accuracy rates for sexual orientation categorizations, we computed the proportion of correct categorizations within each participant. Overall, accuracy of sexual orientation categorizations was not different from

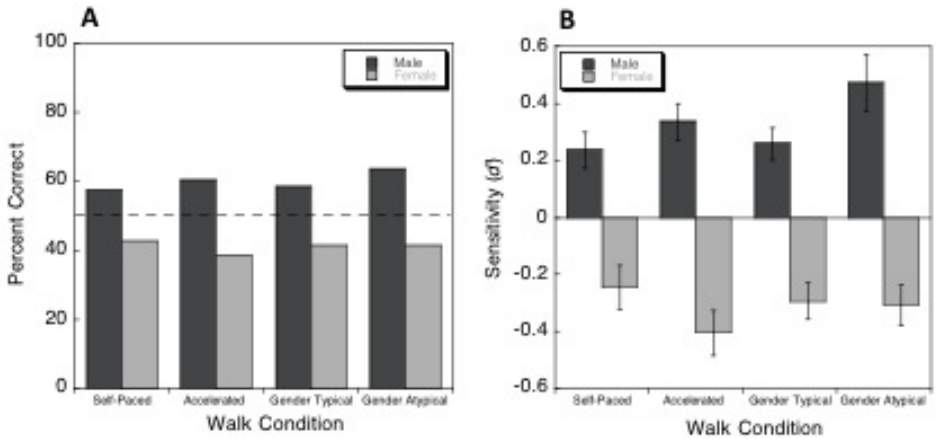

FIGURE 2. Percent of correct sexual orientation categorizations (A) and mean sensitivity to sexual orientation cues in body motions (B) as a function of target sex and walk condition in Study 2. Error bars depict standard errors around each mean.

chance (M = 50.32% correct), $t(53) = 0.36$, $p = .7241$. Given previous findings that perceivers use gendered body motion to accurately judge male but not female sexual orientation, however, it was possible that accuracy varied by target sex. Indeed, the accuracy of sexual orientation categorizations was significantly above chance for male targets (M = 59.78% correct), $t(53) = 44.79$, $p < .0001$, but below chance for female targets (M = 40.86% correct), $t(53) = 29.46$, $p < .0001$.

Next, we tested whether accuracy varied as a function of deliberately gendered walk motions and stimulus characteristics by regressing Accuracy onto Target Sex, Perceived Gender, Walk Condition, and all interactions. Overall, sexual orientation categorization accuracy was higher for male than for female targets (Ms = 64.13% and 40.62%), $\chi^2(1) = 29.39$, $p < .0001$. Furthermore, we uncovered a two-way interaction between Walk Condition and Target Sex, $\chi^2(3) = 9.24$, $p = .0262$ (Figure 2A).

Planned contrasts revealed that the effect of target sex (i.e., higher accuracy categorizing the sexual orientation of male relative to female targets) was stronger in the accelerated and gender-atypical walk conditions relative to the self-paced condition, Bs = −0.11 and −0.10, SEs = 0.04 and 0.04, zs = −2.75 and −2.41, ps = .0060 and .0160. Thus, similar to Study 1, target characteristics and deliberate attempts to change body movement interactively affected the accuracy of social perceptions drawn from gait patterns.

Sensitivity. Next, we conducted signal detection analyses to test perceivers' sensitivity to sexual orientation cues in walk motions while controlling for response biases. We coded correct gay categorizations as hits and correct straight categorizations as correct rejections, computing sensitivity (d') using standard algorithms (Stanislaw & Todorov, 1999). Overall, d' was not different from 0 (see Table 4), $t(53) = 0.23$ $p = .8190$, suggesting that perceivers were not sensitive to sexual orientation cues in walk motions. However, sensitivity was above chance for male targets, $t(53) = 9.00$, $p < .0001$, but below chance for female targets, $t(53) = -8.58$, $p < .0001$. These results corroborate our earlier finding that perceivers are sensitive to sexual orientation cues in body motions of men but not women.

TABLE 5. Contrasts Comparing Sensitivity (*d'*) Within Each Walk Condition by Target Sex (Male vs. Female Target) in Study 2

Walk Condition	Contrast Value (Ψ)	*SE*	*F*	*P*
Self-Paced	0.48	.10	25.80	<.0001
Accelerated	0.74	.10	56.41	<.0001
Gender-Typical	0.55	.10	33.03	<.0001
Gender-Atypical	0.78	.13	35.74	<.0001

Next, we examined whether sensitivity varied as a function of target characteristics and deliberate walk motions using a 2 (Target Sex: male, female) × 4 (Walk Condition: self-paced, accelerated, gender typical, gender atypical) repeated-measures ANOVA. As expected, sensitivity was higher for male relative to female targets, $F(1, 53) = 90.51$, $p < .0001$, $\eta_P^2 = .63$, but it did not vary by Walk Condition, $F(3, 159) = 1.30$, $p = .2751$, $\eta_P^2 = .02$. These effects were qualified by a marginal two-way interaction between Target Sex and Walk Condition, $F(3, 159) = 2.34$, $p = .0756$, $\eta_P^2 = .04$. (All pairwise comparisons appear in Tables 5 and 6.) While sensitivity was significantly above chance for male targets and significantly below chance for female targets (Table 4), planned contrasts revealed that the magnitude of this difference varied across walk conditions (Figure 2B). In particular, sensitivity differences between male and female targets were lowest for self-paced walks, contrast = .48, SE = .10, $F(1, 53) = 25.80$, $p < .0001$, and highest for gender-atypical walks, contrast = .78, SE = .13, $F(1, 53) = 35.74$, $p < .0001$. Thus, perceivers' tendency to correctly categorize male sexual orientations and incorrectly categorize female sexual orientations was especially strong for deliberately gender-atypical gaits.

DISCUSSION

This was the first study to explore sexual orientation perceptions that relied solely on body motions isolated in point-light displays. We found that accuracy was above chance for sexual orientation categorizations of men, but below chance for categorizations of women. Moreover, categorizations varied as a function of both target sex and deliberately gendered gaits—women who enacted accelerated and gender-atypical gaits were especially prone have their sexual orientation miscategorized relative to men. These findings suggest that sexual orientation perceptions are closely tethered to gendered walk motions and that men's deliberately gender-atypical gaits may betray their sexual orientations whereas women's deliberately gender-atypical gaits may conceal theirs.

GENERAL DISCUSSION

Across two studies, we found that gendered body motions were strongly related to both sex and sexual orientation categorizations, and that the accuracy of these judgments varied according to deliberate altered body motions. For sex categorizations (Study 1), accuracy increased when targets enacted gender-typical gaits

TABLE 6. Contrasts Comparing Sensitivity (d') Across Walk Conditions for Male and Female Targets in Study 2

Walk Conditions		Contrast Value (Ψ)	*SE*	*F*	*P*
Male Targets					
Self-Paced					
	Accelerated	–.10	.09	1.39	.2446
	Typical	–.02	.07	0.11	.7455
	Atypical	–.24	.10	5.99	.0178
Accelerated					
	Typical	.08	.08	0.95	.3335
	Atypical	–.14	.11	1.42	.2390
Typical					
	Atypical	–.21	.11	3.94	.0522
Female Targets					
Self-Paced					
	Accelerated	.16	.10	2.56	.1155
	Typical	.05	.09	0.28	.5992
	Atypical	.06	.10	0.40	.5303
Accelerated					
	Typical	–.11	.08	1.75	.1915
	Atypical	–.10	.09	1.16	.2871
Typical					
	Atypical	.02	.08	.03	.8573

but decreased when targets enacted gender-atypical gaits. Accuracy also varied by target sexual orientation, such that sex categorizations were more accurate for straight relative to lesbian/gay targets. Most intriguingly, observers tended to miscategorize the sex of lesbian/gay targets who walked in a deliberately gender-atypical fashion, suggesting that gay men and lesbians modified gendered aspects of their gait effectively enough to derail one of the most basic social categorizations. For sexual orientation categorizations (Study 2), accuracy was high for male targets but low for female targets. Furthermore, accuracy varied as a function of both target sex and deliberate gaits. Sexual orientation categorizations tended to be accurate for men, but inaccurate for women, especially when they moved with accelerated or deliberately gender-atypical gaits.

Our results are noteworthy in several respects. First, they bolster a growing literature about the importance of gendered body motion in social perception, extending that work from animations (Johnson & Tassinary, 2005) and dynamic figural outlines (Ambady, Hallahan, & Conner, 1999; Johnson et al., 2007) to point-light displays of real targets. In fact, our studies are the first to demonstrate that both sex and sexual orientation categorizations are governed by gendered perceptions drawn from body motions isolated in the form of point-light displays.

Second, while researchers have often acknowledged that intentional gaits might affect social perceptions, ours are among just a handful of studies to test this proposition systematically and the first to simultaneously explore the impact of intentionally gendered gaits on the related perceptions of sex and sexual orientation. We found that sex categorization accuracy increased when targets enacted gender-

typical gaits, but decreased when they enacted gender-atypical gaits. These trends were most apparent for lesbian/gay targets, who were systematically miscategorized when walking in gender-atypical ways. Furthermore, sexual orientation categorizations were more accurate for men as opposed to women; female targets were most likely to be miscategorized when altering gendered aspects of their gait. Collectively, these findings confirm that deliberate gait changes can influence basic social perceptions, although the effectiveness of those changes depends on one's social identities.

There are several potential reasons for the interactions we uncovered between targets' social identities and deliberate body motions in predicting categorization accuracy. On the one hand, gay men and lesbians may be more practiced than straight individuals at altering their gaits. Indeed, policies such as "Don't Ask, Don't Tell" have required that gay men and lesbians hide their sexual orientations in order to retain employment; frequent exposure to this sort of policy might make lesbians and gay men especially adept at altering their appearance in order to manage others' social perceptions. On the other hand, perceivers may simply categorize lesbian and gay individuals less accurately to begin with, requiring less extreme modifications to achieve the miscategorizations we observed. Both explanations are consistent with our data; future studies are necessary to tease apart these possibilities.

Finally, our results suggest that some aspects of gendered body motion may be routinely controlled, even if outside of conscious awareness. In particular, we found that sex categorizations were less accurate for accelerated relative to self-paced walks. We suspect that acceleration impaired targets' abilities to monitor the gender typicality of their movement; consequently, their gaits became less gender-typical as walking speed increased, and categorization accuracy dropped. Thus, aside from extreme cases when individuals purposefully alter their gaits, our findings suggest that individuals may constantly monitor their gendered body motions in ways that guide others' perceptions of their social identities.

While our findings pertain specifically to walk motions, social identities are also discerned from facial features (Freeman, Johnson, Ambady, & Rule, 2010; Rule & Ambady, 2008) and behavioral cues (Sylva et al., 2010). Some of these cues may be more diagnostic of social identities and more malleable than others. As research continues, comparing the diagnosticity and malleability of visual cues across various channels of communication will provide a fuller understanding of how targets' motivations evoke desired social perceptions in observers.

In summary, observers attend to gendered body motions to categorize others' social identities, including sex and sexual orientation. In the current studies, we found that deliberate modifications of gendered body motions altered observers' basic perceptions of sex and sexual orientation. Moreover, the direction and magnitude of these effects depended on other personal characteristics of the target

(e.g., sexual orientation). Thus, we found that deliberate changes to gendered gaits can indeed alter basic social categorizations in systematic and sometimes dramatic ways. These findings pave the way for new studies to address the role of targets' intentions across the allied fields of biological motion perception, social psychology, and social vision.

REFERENCES

Ambady, N., Hallahan, M., & Conner, B. (1999). Accuracy of judgments of sexual orientation from thin slices of behavior. *Journal of Personality and Social Psychology, 77,* 538–547.

Brebner, J. L., Martin, D., & Macrae, C. N. (2009). Dude looks like a lady: Exploring the malleability of person categorization. *European Journal of Social Psychology, 36,* 1109–1119.

Buss, D. M. (1989). Sex differences in human mate preferences: Evolutionary hypotheses tested in 37 cultures. *Behavioral and Brain Sciences, 12,* 1–14.

Cohen, C. E. (1981). Person categories and social perception: Testing some boundaries of the processing effect of prior knowledge. *Journal of Personality and Social Psychology, 40,* 441–452.

DePaulo, B. M. (1992). Nonverbal behavior and self-presentation. *Psychological Bulletin, 111,* 203–243.

Freeman, J. B., Johnson, K. L., Ambady, N., & Rule, N. (2010). Sexual orientation perception involves gendered facial cues. *Personality and Social Psychology Bulletin, 36,* 1318–1331.

Gunns, R. E., Johnston, L., & Hudson, S. M. (2002). Victim selection and kinematics: A point-light investigation of vulnerability to attack. *Journal of Nonverbal Behavior, 26,* 129–158.

Heilman, M. E., Wallen, A. S., Fuchs, D., & Tamkins, M. M. (2004). Penalties for success: Reactions to women who succeed at male gender-typed tasks. *Journal of Applied Psychology, 89,* 416–427.

Herek, G. M., Cogan, J. C., & Gillis, J. R. (2002). Victim experiences in hate crimes based on sexual orientation. *Journal of Social Issues, 58,* 319–339.

Johnson, K. L., & Carpinella, C. (2012). Social categorization at the crossroads: Mechanisms by which intersecting social categories bias social perception. In J. Forgas, K. Fiedler, & C. Sedikides (Eds.), *Social thinking and interpersonal behavior: Proceedings of the 14th Sydney Symposium of Social Psychology* (pp. 201–220). New York: Psychology Press.

Johnson, K. L., Gill, S., Reichman, V., & Tassinary, L. G. (2007). Swagger, sway, and sexuality: Judging sexual orientation from body motion and morphology. *Journal of Personality and Social Psychology, 93,* 321–334.

Johnson, K. L., & Tassinary, L. G. (2005). Perceiving sex directly and indirectly: Meaning in motion and morphology. *Psychological Science, 16,* 890–897.

Johnston, L., Hudson, S. M., Richardson, M. J., Gunns, R. E., & Garner, M. (2004). Changing kinematics as a means of reducing vulnerability to attack. *Journal of Applied Social Psychology, 34,* 514–537.

Kozlowski, L. T., & Cutting, J. E. (1977). Recognizing the sex of a walker from a dynamic point-light display. *Perception & Psychophysics, 21,* 575–580.

Maclin, O. H., & Malpass, R. S. (2003). The ambiguous-race face illusion. *Perception, 32,* 249–252.

McArthur, L. Z., & Baron, R. M. (1983). Toward an ecological theory of social perception. *Psychological Review, 90,* 215–238.

Murray, M. P., Kory, R. C., & Sepic, S. B. (1970). Walking patterns of normal women. *Archives of Physical Medicine and Rehabilitation, 51,* 637–650.

Pachankis, J. E. (2007). The psychological implications of concealing a stigma: A cognitive-affective-behavioral model. *Psychological Bulletin, 133,* 328–345.

Pollick, F. E., Kay, J. W., Heim, K., & Stringer, R. (2005). Gender recognition from point-light walkers. *Journal of Experimental*

Psychology: Human Perception and Performance, *31*, 1247–1265.

Rule, N. O., & Ambady, N. (2008). Brief exposures: Male sexual orientation is accurately perceived at 50 ms. *Journal of Experimental Social Psychology, 44,* 1100–1105.

Runeson, S., & Frykholm, G. (1983). Kinematic specification of dynamics as an informational basis for person-and-action perception: Expectation, gender recognition, and deceptive intention. *Journal of Experimental Psychology: General, 112,* 585–615.

Simmons, J. P., Nelson, L. D., & Simonsohn, U. (2011). False-positive psychology: Undisclosed flexibility in data collection and analysis allows presenting anything as significant. *Psychological Science, 22,* 1359–1366.

Stanislaw, H., & Todorov, N. (1999). Calculation of signal detection theory measures. *Behavior Research Methods, 31,* 137–149.

Sylva, D., Rieger, G., Linsenmeier, J. A. W., & Bailey, J. M. (2010). Concealment of sexual orientation. *Archives of Sexual Behavior, 39,* 141–152.

Zeger, S. L., & Liang, K. Y. (1986). Longitudinal data analysis for discrete and continuous outcomes. *Biometrics, 42,* 121–130.