Research Article

Perceiving Sex Directly and Indirectly

Meaning in Motion and Morphology

Kerri L. Johnson[1] and Louis G. Tassinary[2]

[1]New York University and [2]Texas A&M University

ABSTRACT—*We employed a novel technique to explore how the body's motion and morphology affect judgments of sex and gender. Stimuli depicted animated human walkers that varied in motion (gait patterns varying shoulder swagger and hip sway) and in morphology (waist-to-hip ratio). The potency of morphology in categorical sex judgments was confirmed. Visual scanning of the walkers was concentrated in the waist and hip region of the body (Study 1a). This targeted scanning was attenuated, however, when the sex of the target had been prespecified (Study 1b). Body motion permitted categorical judgments of sex, but these judgments were mediated by perceived gender (Study 2). These studies provide converging evidence for the primacy of the body's shape in categorical judgments of sex.*

Between 1990 and 1994, "Saturday Night Live" featured 18 sketches of a sexually ambiguous character named Pat, played by Julia Sweeney. Not quite masculine, not quite feminine, Pat was funny because of his/her androgyny. In Pat's case, every cue that tends to be sexually dimorphic (e.g., hairstyle, clothing, body shape, voice) was uninformative, leaving the character's sex a mystery. In real life, people may experience fleeting moments in which they are uncertain of someone's sex, but such occasions are rare. Sex recognition is facilitated by numerous cues, and many of these cues have their foundations in the dynamic structure of the body. The present experiments explored the relative importance of two bodily cues—motion and morphology—for this fundamental social judgment.

Address correspondence to Kerri Johnson, Department of Psychology, New York University, 6 Washington Pl., 7th Floor, New York, NY 10003, e-mail: kerri.johnson@nyu.edu, or to Louis G. Tassinary, Office of the Dean, College of Architecture, Texas A&M University, College Station, TX 77843-3137, e-mail: lou@archone.tamu.edu.

Perceiving the sex of other individuals has been described as a compulsory judgment (e.g., Stangor, Lynch, Duan, & Glass, 1992), yet pinpointing the mechanisms that underlie this judgment has remained difficult. Studies investigating the perception of the body's shape and those investigating the perception of the body's motion offer some insights into these mechanisms, but these two lines of research show little overlap. Investigations of the perception of human motion (e.g., Cutting, Proffitt, & Kozlowski, 1978) typically employ dynamic point-light displays that lack potentially informative morphological information. Investigations of aesthetic judgments of body shape (e.g., Singh, 1993), in contrast, typically employ static line drawings that lack potentially relevant motion information. The restricted cues utilized by each research tradition have yielded circumscribed knowledge—insights that are precise but that lack breadth. Our approach, in contrast, integrates these disparate lines of work by using animations that vary in both morphology and motion. This novel approach permits a more complete characterization of the strength with which these cues guide social perception.[1]

MEANING IN MOTION

Men and women walk differently (Kerrigan, Todd, & Della Croce, 1998; Samson et al., 2001; Smith, Lelas, & Kerrigan, 2002), and these differences are apparent to observers. Thus, even though point-light walkers are relatively impoverished, for example, observers accurately identify the sex of these stimuli (Kozlowski & Cutting, 1977). These categorical percepts emerge because of distinct motion patterns in the shoulders and hips (Cutting, 1978; McLaughlin, 1994; Murry, Kory, & Sepic, 1970). "Female" motion is characterized by more hip translation than

[1]This particular approach is novel, but the use of animated figures and cartoons has a history of elucidating issues at the interface of social and cognitive psychology (see, e.g., Heider & Simmel, 1944, and Oatley & Yuill, 1985).

shoulder twist, but the opposite is true for "male" motion (Barclay, Cutting, & Kozlowski, 1978; Cutting et al., 1978).

These prior experiments are mute, however, with respect to the impact of body shape on sex perception, although it has been accepted generally that the body's shape constrains its motion, and this results in sexually dimorphic gaits (e.g., Cutting, 1986, p. 283, footnote 6; Cutting et al., 1978; cf. Mather & Murdoch, 1994).

MEANING IN MORPHOLOGY

Men's and women's bodies are shaped differently, according to both absolute (height and weight) and relative (shape) measures. Observers utilize these differences when making social judgments. For example, the size of a target's waist affects both sex and gender (i.e., perceived masculinity and femininity) judgments about the target. In a seminal publication, Lippa (1983) reported that participants' judgments of sex were tightly coupled to the width of targets' waists ($\beta = .84$), yet less influenced by the breadth of targets' shoulders ($\beta = .22$). A similar pattern obtained for gender judgments (βs = .65 for waist and .49 for shoulders). Lippa speculated that "the 'waistedness' of the body outline [is] a dominant cue to gender" (p. 673).

The relative size of a target's waist, specifically, the *waist-to-hip ratio* (WHR), also affects evaluative social judgments. The WHR is related to health and fertility (Bjorntorp, 1988; Ostlund, Staten, Kohrt, Schultz, & Malley, 1990; Zaadstra et al., 1993) and to perceived attractiveness (Henss, 1995, 2000; Singh, 1993). Small WHRs ("hourglass" figures) are deemed more attractive than larger WHRs (tubular figures), at least for female targets. The mechanisms relating WHR to attractiveness have been a source of controversy (see, e.g., Tassinary & Hansen, 1998; Tovée, Maisey, Emery, & Cornelissen, 1999), but the interpersonal significance of WHR has not (e.g., Furnham, Tan, & McManus, 1997).

MORPHOLOGY IN MOTION

Morphology, specifically, waist size, is a critical cue for perceiving sex. Yet motion is also a sufficient cue for perceiving sex. The relative importance of these cues remains unknown, however, because of differences in both the stimuli and the methods of prior research.

The stimuli used previously to investigate social perception convey different information. Line drawings, by design, convey morphology, but not motion. Point-light walkers, in contrast, convey motion, but not morphology. Specifically, point-light walkers neglect the waist—an omission that precludes the appreciation of body curves. That said, some researchers have attempted to vary morphology in point-light walkers by altering the width of the shoulders and hips (*shoulder-to-hip ratio*, SHR; Mather & Murdoch, 1994). This manipulation, however, provides virtually no information about body curves and was found to have little effect on the perception of sex.

Methodologically, these approaches have differed also in the specific social judgments requested. In studies using point-light walkers, participants have judged only sex. In studies using line drawings, participants have judged attractiveness, sex, or gender. These restrictions may have veiled important distinctions in how motion and morphology differentially affect a family of social judgments—including judgments of both sex and gender.

Given these differences in stimuli and methodology, it remains unknown whether morphology or motion is more important for sex perception. Previous investigations of the relative importance of motion and morphology may have underestimated the impact of morphology because (a) the morphological feature manipulated lacked social relevance or visual salience and (b) observers judged only sex.

To overcome these limitations, Higa (1999) developed stimuli that varied in motion (gait) and morphology (WHR). The stimuli, hereafter called *walkers*, depicted an animated human of ambiguous sex walking in place. In the present research, we utilized these stimuli to explore the relative importance of motion and morphology for judgments of sex, and to examine the mechanisms that permit sex to be perceived from either motion or morphology.

Our first goal was to establish the importance of morphology in sex perception. Our second goal was to determine the mechanisms that undergird sex perception. We propose that sex perception via morphology is direct, but that sex perception via motion is indirect. When motion information is available, the motion is first perceived to be either masculine or feminine; then, the target's sex is inferred. Said differently, perception of sex from motion is hypothesized to be mediated by perception of gender.

STUDIES 1A AND 1B

> When my optic nerves observe your curves, then suddenly, I want to crush you close . . . .
>
> —Bobby Darrin ("The Breaking Point")

As this lyric implies, and as previous research intimates, looking at a body's "curves" is likely to provoke certain social perceptions. Although Darrin opined about longings that are related to perceived attractiveness, observing body curves in motion is also likely to be related to more fundamental social judgments, such as judgments of sex and gender. Specifying which cues inform each kind of judgment was our goal in Studies 1a and 1b.

Study 1a examined how people judge the sex and gender of other individuals. We predicted that morphology (i.e., WHR) would relate to perceptions of sex and that the body's motion (i.e., gait) would relate to perceptions of gender (i.e., masculinity

and femininity). A critical aspect of these predictions, heretofore unverified, was that people would, quite literally, "observe curves" to inform social judgments. That is, we predicted that people would direct their attention to the waist and hips of a target.

Study 1b corroborated that sex judgments, in particular, rely on morphology. We disambiguated (prespecified) the walkers' sex for some, but not all, participants, and we measured how this manipulation affected visual scanning of the waist and hips. Believing that morphology informs sex judgments, we predicted that scanning of the waist and hips would decrease significantly when sex was prespecified.

Study 1a

Method

Participants. Twenty-five undergraduates (11 women, 14 men) participated for course credit. Data from 2 women and 2 men were excluded because of faulty eye movement calibration.

Apparatus, Stimuli, and Procedure. Twenty-five stimuli depicted an animated human walking in place[2] (see Higa, 1999). The stimuli represented five WHRs, ranging from 0.5 (i.e., hourglass figure) to 0.9 (i.e., tubular figure), and five walk motions, ranging from extreme shoulder swagger to extreme hip sway (see Table 1). All observable sex characteristics (e.g., facial hair, breasts, and genitals) were removed. Walkers were 44.0 cm tall (20.1° visual angle) and were presented using a Macintosh computer and 76-cm monitor. Eye movements were recorded at 60 Hz with a spatial resolution of ±0.5° using an Applied Science Laboratories Model 504 corneal-reflection eyetracker.

Participants sat approximately 120 cm from the monitor in a darkened room and previewed each walker while eye movements were recorded. Calibration was done individually by registering nine known fixation points. Then, the room lights were illuminated, and participants reviewed each walker and judged its sex, gender (two judgments—masculinity and femininity), and attractiveness.[3] Because judgments of attractiveness are beyond the scope of the current article, they receive no further mention.

Results and Discussion

Judgments. First, we examined the relative importance of motion and morphology for judgments of sex and gender. Initially, participant's sex was included as a factor in these analyses, but it was dropped because it did not affect the pattern of results. Judgments were analyzed (separately) using 5 (WHR) × 5 (walking motion) repeated measures analyses of variance (ANOVAs).

TABLE 1
Relative Motion of the Shoulders and Hips for Each Walk Motion

Motion parameter	Walk motion				
	Extreme sway	Sway	Neutral	Swagger	Extreme swagger
Hip motion					
Twist	8.37	6.44	4.12	1.69	1.69
Side-to-side	13.00	10.00	1.60	0.43	0.43
Shift	0.02	0.015	0	0	0
Shoulder motion					
Twist	1.69	1.69	4.12	6.44	8.37
Side-to-side	0.34	0.34	0.85	1.36	1.768

Note. Units express precise key-frame modifications in Poser units (adapted from Higa, 1999). For both shoulder and hip motion, "twist" refers to the degree of rotation about the figure's spine, "side-to-side" refers to the degree of rotation about the navel, and "shift" refers to lateral left/right displacement of the body. Walkers with moderate sway and swagger embody gaits that are characteristic of actual men and women, and interpolations between these values generated a neutral motion (i.e., described by Cutting, 1978, and Cutting, Proffitt, & Kozlowski, 1978; modeled by McLaughlin, 1994). Extreme swagger and extreme sway amplify the sex-typical motions by 30% (Higa, 1999).

Sex judgments were more strongly influenced by morphology than by motion. Hourglass figures were perceived to be women, and this resulted in a significant and sizable main effect for WHR, $F(4, 96) = 153.96$, $p < .01$, $\eta^2 = .87$. Compared with swaggering walkers, swaying walkers were more often perceived to be women, and this resulted in a significant, yet remarkably smaller, main effect for walk motion, $F(4, 96) = 4.57$, $p < .01$, $\eta^2 = .16$.

Gender judgments were equally influenced by morphology and motion. Compared with walkers with larger WHRs, those with smaller WHRs were judged as more feminine, resulting in a significant main effect for WHR, $F(4, 96) = 24.33$, $p < .01$, $\eta^2 = .50$. Compared with swaggering walkers, swaying walkers were judged as more feminine, resulting in a significant main effect for walk motion, $F(4, 96) = 27.64$, $p < .01$, $\eta^2 = .54$.

Eye Movements. We defined four areas of interest (AOIs)—head, chest, waist-hips, and legs. Our eye movement measures, collapsed across walkers for each participant, were dwell time (i.e., looking time in the AOI divided by total looking time) and number of fixations (i.e., instances in which gaze remained within 0.5° for at least 100 ms). The data were analyzed (separately) using 2 (participant's sex) × 4 (AOI) ANOVAs to determine if AOIs were scanned differentially.

On average, the waist and hips received 40.02% of dwell time and 9.91 fixations, the chest received 22.61% of dwell time and 6.57 fixations, the legs received 8.14% of dwell time and 2.45 fixations, and the head received only 3% of dwell time and 0.96

[2]Walkers were rendered using Poser 4® (Curious Labs). Wire frames were exported to Maya® (Alias Systems Corp.) for accurate circumference measurements. Poser's default walk designer was modified to animate five walk motions: extreme sway, moderate sway, neutral, moderate swagger, and extreme swagger. Each animation lasted for 10 s. Walkers completed 10 steps.

[3]Higa (1999) also reported perceptions of each walker's sex, masculinity, femininity, and attractiveness. The judgments in Study 1a provide a direct replication of those findings.

fixations, Fs(3, 69) = 50.10 and 65.23, ps < .01, η^2s = .69 and .74, for dwell time and fixations, respectively. Overall, participants looked more at the waist-hips AOI than at any other AOI, contrast Fs(1, 24) = 63.80 and 72.64, both ps < .01, η^2s = .73 and .75, respectively. Compared with women, men looked longer and more often at the chest but less at the waist and hips, resulting in significant AOI × Participant's Sex interactions, Fs(3, 69) = 3.89 and 4.28, ps < .01, η^2s = .15 and .16, respectively. Nevertheless, internal analyses confirmed that men showed the same overall looking pattern as women, scanning the waist and hips more than other AOIs, overall Fs(3, 36) = 19.50 and 27.41, ps < .01, η^2s = .62 and .70; contrast Fs(1, 12) = 26.40 and 27.02, ps < .01, η^2s = .69 and .70.

This looking pattern did not obtain simply because the AOIs differed in size. We analyzed whether dwell time within each AOI was significantly different from that area's proportional physical size. The waist-hips AOI was 27% of the display; visual scanning (i.e., dwell time) there was above chance, $F(1, 24) = 17.29$, $p < .01$, $\eta^2 = .42$. Scanning within the head and legs AOIs (13% and 36% of the display) was below chance, Fs(1, 24) = 294.27 and 280.33, both ps < .01, η^2s = .93 and .92, respectively. Scanning within the chest AOI (24% of the display) did not differ from chance, $F(1, 24) = 0.236$, n.s., $\eta^2 = .01$.

These results highlight the importance of morphology for sex perception. Indeed, sex judgments were more strongly related to WHR than to walking motion. Additionally, participants looked more at the waist and hips than at any other AOI. Yet because participants provided numerous social judgments about each walker, the information they gleaned when scanning this critical area remains unclear. In Study 1b, we examined whether this targeted scanning was to inform sex judgments specifically, by disambiguating the walkers' sex for a subset of participants. We expected this manipulation to reduce scanning of the waist and hips.

Study 1b

Method

Participants. Twenty-six undergraduates (15 women, 11 men) participated for course credit.

Apparatus, Stimuli, and Procedure. The procedures for eye tracking and stimulus presentation were identical to those described for Study 1a. For this study, however, we used only the five walkers with a WHR of 0.7 because the apparent sex of these walkers was equivocal (58% of participants in Study 1a judged them to be women). This ambiguity made the manipulation of purported sex more tenable than for walkers with more exaggerated WHRs.

The protocol was identical to that of Study 1a, but some participants received additional information regarding the walkers' purported sex. In the *sex-specified* condition, the walkers' sex was disambiguated by telling participants that the walkers were based on the motion of actual men (or women). In the *sex-unspecified* condition, participants judged the walkers' sex. After providing all key dependent measures, participants in the sex-specified condition were asked to recall the sex of the walkers that they viewed.

Results

Because our predictions for Study 1b concerned how our manipulation would affect visual scanning of the walkers, we do not discuss participants' judgments.

Manipulation Check. All participants in the sex-specified condition accurately reported the sex that had been specified to them.

Eye Movements. Participant's sex was initially included as a factor in analyses. No effect involving this variable approached significance, and it was therefore dropped from the analyses. Thus, dwell times and fixations were analyzed using separate 2 (condition) × 4 (AOI) ANOVAs to determine if scanning varied as a function of our manipulation.

As shown in Figure 1, participants spent more time looking at and allocated more fixations toward the waist-hips AOI than any other AOI, Fs(3, 69) = 35.63 and 44.89, both ps < .01, η^2s = .59 and .65, respectively. However, this pattern differed by condition, resulting in significant AOI-by-condition interactions for both measures, Fs(3, 69) = 3.46 and 3.04, both ps < .05, η^2s = .12 and .10, respectively. Compared with participants in the sex-unspecified condition, participants in the sex-specified condition spent significantly less time scanning the waist and hips and also fixated the waist and hips fewer times, Fs(1, 25) = 4.18 and 4.88, ps = .05 and .04, η^2s = .14 and .16, respectively. This pattern was not observed for any other AOI, Fs < 2.1, n.s.

If participants attended to the waist-hips area to determine the walkers' sex, as we have suggested, then visual scanning targeting this AOI should have been above chance only when the walkers' sex was unspecified. We again tested this empirically by checking whether the dwell time for each AOI was different from the proportion of the display that AOI accounted for. Scanning of the waist-hips AOI did not differ from chance (27%) in the sex-specified condition, $F(1, 17) = 3.03$, n.s., $\eta^2 = .15$, but scanning of this area was above chance in the sex-unspecified condition, $F(1, 8) = 20.85$, $p < .01$, $\eta^2 = .72$. This pattern of results was not present for the other AOIs.

Discussion

Study 1b provides converging evidence that morphology—specifically, morphology in the waist and hips—is a cue for determining biological sex. Participants paid particular attention to a sexually dimorphic area, the WHR (Study 1a), but only when they needed to determine a target's sex (Study 1b). The precipitous drop in scanning of the waist and hips when the

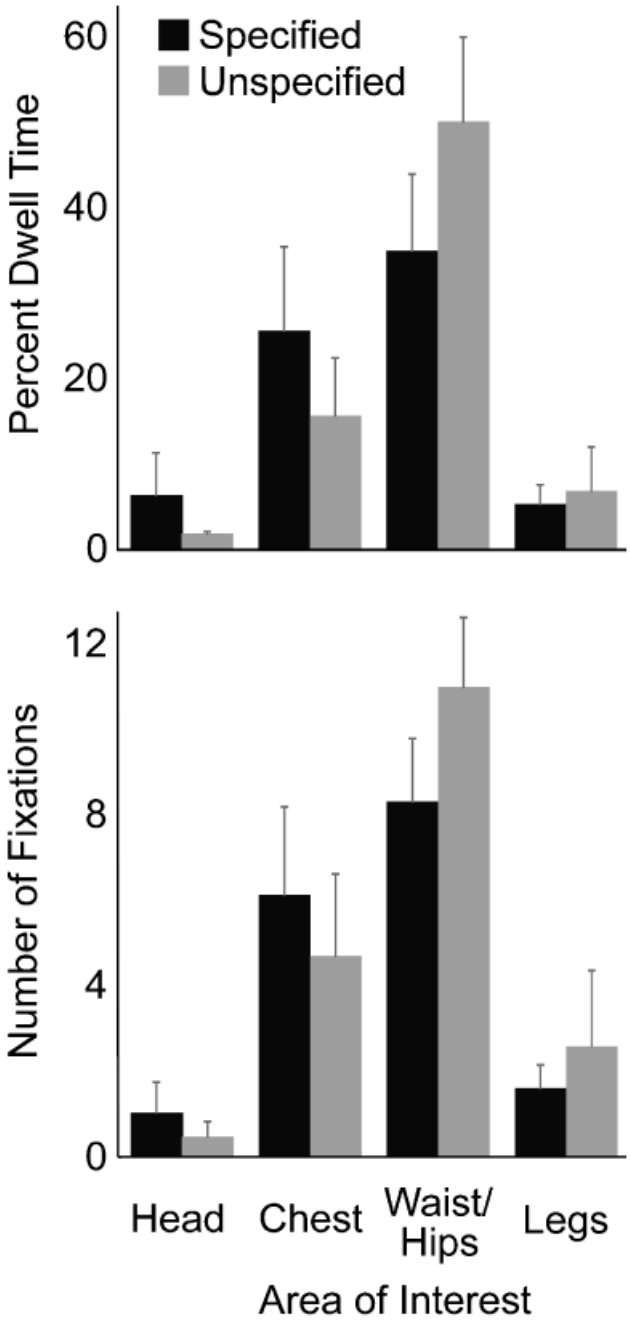

Fig. 1. Eye movement results in Study 1b: dwell times (top) and fixations (bottom) in each area of interest for participants who were told the sex of the walkers (''specified'') and participants who were not told the sex of the walkers (''unspecified''). Error bars represent 95% confidence intervals.

walkers' sex had been prespecified is striking—especially considering that the movement in this AOI varied across the walkers. Together with the judgment data, these results highlight the potency of morphology as a cue for perceiving sex.

Note that these surprising results could not have been predicted by, and indeed contextualize the findings of, studies using point-light walkers, which indicate that motion is sufficient to support veridical sex perception. In the present research, we found that motion was more consequential for perceived gender than for perceived sex (η^2s = .54 and .16, respectively). It remains possible, therefore, that motion affects perceived sex indirectly (viz., a target's perceived gender may be appreciated from motion, and from the target's gender, its sex may be inferred). Testing this possibility requires the collection of both sex and gender judgments. Unfortunately, no study using point-light walkers has done this. Study 2 tested this proposed model of mediated sex perception by obtaining sex and gender judgments for a subset of the animated walkers used in Study 1. We used the walkers that were most ambiguous morphologically to see whether sex judgments that relied solely on motion were mediated by perceived gender. First, we conceptually replicated the direct effects observed in studies of point-light walkers (i.e., motion is sufficient for sex perception). Then, we tested our proposed mediational model for sex judgments based on motion.

STUDY 2

Method

Forty-nine undergraduates (34 women, 15 men) participated for either $5.00 or extra credit. Data from 1 male participant were excluded because he left multiple responses blank.

Five walkers with a WHR of 0.7 were projected onto a screen in a lecture auditorium. Participants first previewed each of the five walkers with the room lights dimmed. Following this inspection, participants reviewed the walkers (in a different order) and provided judgments of sex, gender (i.e., masculinity and femininity), and attractiveness.

Results and Discussion

Judgments of sex were coded numerically (1 = male, 2 = female). The five levels of walk motion were also coded numerically (extreme sway = 1, moderate sway = 2, neutral = 3, moderate swagger = 4, and extreme swagger = 5). Scaled judgments of masculinity and femininity were converted into proportions, and the complement of perceived masculinity was averaged with perceived femininity to yield a single gender index (higher numbers indicate a more feminine percept).

We analyzed the judgments to determine whether walk motion had a direct or a mediated effect on perceived sex (see Fig. 2a). Although we used a multilevel mediational test that uses hierarchical linear modeling to estimate each parameter (Kenny, Korchmaros, & Bolger, 2003), we employ the standard vernacular (i.e., Baron & Kenny, 1986) to describe our results. Participant's sex was included as a control predictor, yet it did not qualify any of the effects described here.

First, we regressed perceived sex on walk motion. The relation was positive and significant, $B = 0.133$, $t(48) = 6.25$, $p < .01$, odds ratio (OR) = 1.70 (Hosmer & Lemeshow, 2000, p. 49). This direct effect replicates previous findings: Motion is sufficient for sex perception. Next, we regressed perceived gender on walk

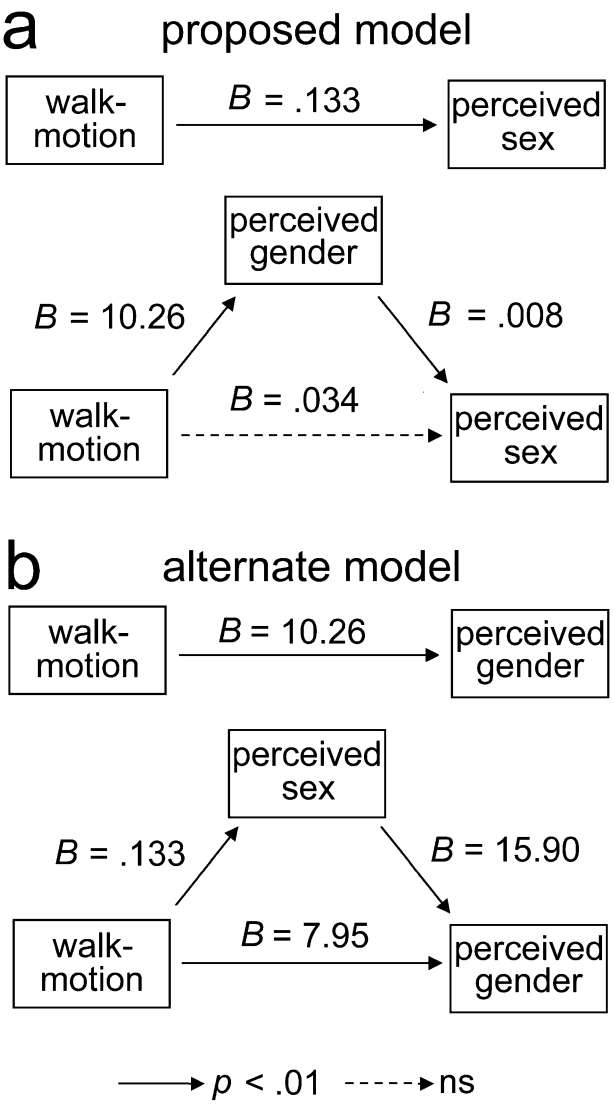

Fig. 2. Path analyses for the relations among walk motion, perceived gender, and perceived sex. All effects were estimated controlling for participant's sex. The diagrams show results for our proffered model (a), in which the relation between walk motion and perceived sex is mediated by perceived gender, and an alternate model (b), in which the relation between walk motion and perceived gender is mediated by perceived sex. All parameter estimates are unstandardized coefficients.

motion; the relation was positive and significant, $B = 10.26$, $t(48) = 9.94$, $p < .01$. Finally, we regressed perceived sex on both perceived gender and walk motion. The relation between perceived sex and perceived gender was positive and significant, $B = 0.008$, $t(48) = 5.09$, $p < .01$. Critically, the effect of walk motion, mediated by perceived gender, on perceived sex dropped to nonsignificance, $B = 0.034$, $t(48) = 1.29$, n.s., OR = 1.14.

We also tested an alternate mediational model to determine if perceived sex mediated the relation between walk motion and perceived gender (see Fig. 2b). First, we regressed perceived gender on walk motion; the relation was positive and significant, $B = 10.26$, $t(48) = 9.94$, $p < .01$. Next, we regressed perceived sex on walk motion; the relation was positive and significant, $B = 0.133$, $t(48) = 6.25$, $p < .01$. Finally, we regressed perceived gender on walk motion and perceived sex. The relation between perceived sex and perceived gender was positive and significant, $B = 15.90$, $t(48) = 5.05$, $p < .01$. Critically, the mediated relation between walk motion and perceived gender remained strong and significant, $B = 7.95$, $t(48) = 7.51$, $p < .01$.

We used structural equation modeling to determine the relative fit for each mediated path just described. The fit for our proffered model was favorable, Akaike's information criterion (AIC) = 20.43, but the fit for the alternate model was not, AIC = 84.71.

These analyses illuminate the mechanism by which motion cues inform sex judgments. When based solely on motion cues, perceived sex is mediated by perceived gender. That is, an individual's motion is perceived to be either masculine or feminine; then, the individual's sex is inferred. These results replicate and extend the findings of studies using point-light walkers. Study 2 also provides converging evidence that motion is a primary cue to gender, and morphology is a primary cue to sex.

GENERAL DISCUSSION

The data reported here establish the importance of the body's morphology for perceived sex. When making social judgments of animated walkers, participants relied on the waist and hips; this reliance was evident in both judgments and visual scanning (Study 1a). This strategic scanning served the categorization of sex; indeed, visual scanning of the waist and hips dropped to chance levels when the sex of the target had been prespecified (Study 1b). Together with previous findings, the results from Studies 1a and 1b raised the intriguing possibility that sex perception, when based solely on motion, is the product of inference—a judgment mediated by perceived gender. This possibility was confirmed using multilevel mediational analyses (Study 2).

Reconciling the Current Results With Previous Results: Alternative Explanations

The present studies establish the importance of morphology in categorical sex judgments. Early studies using point-light displays, however, found that motion alone was sufficient to support veridical sex perception. According to the results of Study 2, these sex judgments of point-light walkers likely occurred in two phases. Participants who encountered the point-light displays first appreciated the masculinity or femininity of the motion. From this perception, the targets' sex was inferred. Gender judgments were not collected in the studies utilizing point-light displays, but this interpretation is consistent with both the prior (e.g., Kozlowski & Cutting, 1977) and the present findings. Moreover, Study 2 provides the critical conceptual replication necessary to substantiate our claim. Participants in both the

prior research and Study 2 apprehended a target of ambiguous sex. In both cases, only motion cues were available to inform sex judgments; little morphological information could be appreciated in the point-light walkers, and the morphological information remained constant in our walkers. Finally, in both cases, sex judgments covaried with body motion.

Discriminating the Sexes

The current studies focused on the importance of motion and morphology for social perception. Clearly, the bodies of men and women in the real world are distinct, and we have argued that morphology dominates sex perception and that motion dominates gender perception. The differences in predictive validity for motion and morphology are not limited to perception. Men and women are more reliably differentiated on the basis of their physical morphology than on the basis of their dynamic motion.

As we stated previously, men and women walk differently, yet the differences are not as dramatic as one might expect. The motions that underlie perceived sex differences in motion have been documented using synthetic walkers (Cutting, 1978), but documenting the kinematics that underlie actual sex differences in motion has been more difficult (Smith et al., 2002). It appears that the sexes differ more in the timing of particular movements than in the actual range of motion (Davis & Gao, 2004; Troje, 2002). Furthermore, it remains unclear whether these differences are due to real sexual dimorphism or sociocultural forces. Though the differences may be small, linear classifiers of human motion are quite accurate compared with human observers (e.g., 85% vs. 70%; Troje, 2002).

The morphological differences between men and women distinguish the sexes with greater reliability than do the motion differences. Although observers generally attend more readily to the WHR than to the SHR, both ratios are sexually dimorphic. When considered together, the three measurements that make up these ratios—measurements of the shoulders, the waist, and the hips—statistically classify individuals with nearly perfect accuracy.[4] These data strengthen our claim that people attend to morphology when making sex judgments. Such a strategy is functional and efficient given the marked separation of male and female somatotypes. Thus, our participants used the best information available to them—the WHR—to inform sex judgments.

Conclusion

The present work expands current understanding of precisely how people judge a target's sex. Although motion and morphology may ultimately lead to the same categorical end, the routes by which these cues lead to social judgments appear to differ: Sex judgments informed by morphology are direct, whereas sex judgments informed by motion are indirect.

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[4]Measurements of 2,542 female and 2,261 male army recruits (Clauser, Tebbetts, Bradtmiller, McConville, & Gordon, 1987–1988; Gordon et al., 1988) were analyzed using sequential logistic regression to determine classification accuracy based on shoulders, waist, and hips. Step 1 regressed sex on the waist and hip measurements, $\chi^2(2) = 4{,}036.21$, $p < .0001$, 89.0% accuracy. Step 2 added shoulder circumference, $\chi^2(1) = 1{,}797.35$, $p < .0001$ (step); $\chi^2(3) = 5{,}833.56$, $p < .0001$ (model), 96.9% accuracy.

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