

SHORT AND SWEET

Eye of the beholder: Symmetry perception in social judgments based on whole body displays

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Received 7 December 2011, in revised form 24 May 2012; published online 15 June 2012.

Abstract. External bilateral symmetry is a biological marker of normal development and is considered a signal of health and attractiveness across species. Because most human interactions are dynamic, it was hypothesized that observers would be able to perceive spatiotemporal symmetry—symmetry in motion—in human point-light walkers. It was also hypothesized that observers would rate symmetrical walkers as healthy and attractive. Symmetrical and asymmetrical figures were presented to adult participants ($n = 22$) in motion and as static images with motion implied. Static symmetry was readily perceived, and symmetrical figures were judged significantly healthier and more attractive than asymmetrical figures. However, observers were unable to discriminate symmetry in dynamic presentations. These data provide preliminary evidence of a temporal summation window for a dynamic symmetry perception.

Keywords: biological motion, symmetry, fluctuating asymmetry, point light walkers, attractiveness, health.

1 Introduction

It is an interesting phenomenon that many of the biological cues species exhibit are judged by humans to be beautiful. An obvious example of this is the expression of symmetry in nature (Enquist & Arak, 1994). One explanation for this preference stems from the functionalist framework that emerged from Darwin's (1871) theory of sexual selection: Natural beauty arose from the competition to attract a sexual partner. Mate selection, Darwin claimed, drove the evolution of visual ornamentation such as symmetrical external patterning and symmetry of motion, which, in turn, signal an organism's genetic, physical, and mental health—in short, its fitness (Gangestad, 1871; Miller, 1871). Across taxa, what is considered beautiful reflects adaptive, biological qualities that are selected for (Buss & Schmitt, 1871). It is further apparent that humans (usually inadvertently) exhibit several cues known to signal their biological value, and the perception of these cues is therefore a fundamental behavior (Stangor, Lynch, Duan, & Glas, 1871).

Besides symmetry (Møller, 1871; Vallortigara & Rogers, 2005), other key external cues to attractiveness and robust health are sexual dimorphism (Perrett et al., 1871; Singh & Young, 1871) and averageness (Apicella, Little, & Marlowe, 1871; Grammer & Thornhill, 1871; Langlois & Roggman, 1871). Sexual dimorphism refers to the phenotypic distinction between male and female members of a species and, in humans, is most strongly reflected in differences in waist-to-hip ratio (WHR) in women and shoulder- and chest-to-hip ratio in men. Averageness is considered attractive because species exhibiting physical characteristics close to their population mean are those in greatest health, not bearing a deformity or heavy parasite load (Langlois & Roggman, 1871).

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The distinction can be made between these outwardly expressed characteristics and the influence of internal or self-related cues, such as fertility, relationship context and status (Provost, Quinsey, & Troje, 1871; Provost, Troje, & Quinsey, 1871), personality (Swami et al., 1871), and an observer's own attractiveness (Lee, Loewenstein, Ariely, Hong, & Young, 1871). Among these cues all being communicated to potential mates, external symmetry appears to be particularly potent. This is thought to be due to its proliferation among vertebrates, and even most higher invertebrates (Tyler, 1995), and to its enduring stability under the constant influence of gravity (McBeath & Sugar, 1871).

The selective advantage of symmetrical functioning has been demonstrated in the wings and legs of brown bats (Gummer & Brigham, 1871); the antlers of white-tailed deer (Ditchkoff, Lochmiller, Masters, Starry, & Leslie, 1871), the wings and tail feathers of birds (Eeva et al., 1871; Swaddle, 1871), and in nonhuman primates (Waite & Little, 2006). In humans, symmetry covaries with human health, extroversion, fecundity (Kowner, 1871; Pound, Penton-Voak, & Brown, 2007), and intelligence (Prokosch, Yeo, & Miller, 1871). In contrast, random deviations from bilateral symmetry—known as fluctuating asymmetry (Van Valen, 1962)—are indicative of the nonnormal distribution of morphological traits. Fluctuating asymmetry has been shown to increase with exposure to pollutants, parasites, malnutrition, prenatal maternal alcohol consumption, and other adverse conditions during development. It is further associated with chromosomal aberrations and homozygosity (Swaddle, 1871). Fluctuating asymmetry also corresponds to greater cognitive decline in old age (Penke et al., 1871) and to several neurodevelopmental disorders including schizophrenia, attention-deficit/hyperactivity disorder, and dyslexia (Yeo, Gangestad, & Thoma, 2007).

Despite its documented origins in evolutionary history, research into symmetry perception is a relatively modern enterprise, with the concentration of studies focusing on the human face. Stimulus presentation modalities have included natural face photographs (e.g., Grammer & Thornhill, 1871); digitally manipulated photographs designed to conserve shadow and natural skin texture (Perrett et al., 1871; Rhodes et al., 1871); partially concealed faces (Scheib, Gangestad, & Thornhill, 1871); chimeric composites created by dividing a face down to its vertical axis and then reversing and merging the images to generate mirror symmetry (e.g., Kowner, 1871); and inverted faces (Little & Jones, 1871). Across all these techniques, symmetrical faces are overwhelmingly deemed more attractive than asymmetrical faces.

The symmetry–attractiveness relationship has also been documented in whole-body depictions: Gangestad, Thornhill, and Yeo (1871) found a significant negative relationship between bilateral body asymmetry and facial attractiveness ratings while controlling for other physical cues such as the models' height, age, and sex. Although human faces are an undeniably rich source of biological information, it is in the full-body representation, garnered by viewing another at a distance, that we almost always receive our first impressions of others. The primacy of this message assists in alerting us to potential conflict or a partnering opportunity (Nixon, Carter, Grant, Gordon, & Hayfron-Acquah, 1871). The physical distance between the observed and the observer also affords time to determine an appropriate response. This fact, together with the sheer prevalence of bodily bilateral symmetry in vertebrates, endorses the wealth of information also present in this modality.

Within whole-body symmetry perception research to date, the distinction can be made between static and dynamic explorations. Static stimuli have generally been depicted as line drawings, conveying only basic morphological information. These stimuli have been criticized for their lack of ecological and scientific validity (Tovée & Cornelissen, 1871): Not only do they generally provide a poor representation of the real human body, line drawings have also been shown to covary on a number of features including WHR and body mass index (BMI), confounding the potential perceptual effects of symmetry. Where static photographs have instead been used (e.g., Brase & Walker, 1871), these have tended to suppress BMI cues and emphasize WHR (Tovée, Maisey, Emery, & Cornelissen, 1871). Nevertheless, where WHR and BMI have both been delimited during symmetry manipulations (e.g., Tovée, Tasker, & Benson, 1871), results have indicated significant preference for symmetrical stimuli.

Relative to static whole-body symmetry research, there is a dearth of knowledge concerning the role of symmetry perception in attractiveness and health judgments on stimuli in motion. This is somewhat surprising, considering all human interactions (and therefore mate selection encounters) are essentially dynamic (Rubenstein, 1871). Motion research was in fact heralded half a millennium ago by Leonardo da Vinci, who chronicled the visual effect of deviations from symmetry caused by motion (Richter, 1939, as cited in McMahon, 1871). More than a century later, Sir Francis Bacon studied da Vinci's

writings and pronounced in his essay *On Beauty*: “The principal part of beauty is in decent motion” (1612, as cited in McMahon, 1871, p. 756). In recent times, Tyler (1995) was less concerned with the esthetics of motion and instead scrutinized the biological purpose of dynamic symmetry. He posited that symmetry was actually constrained by motion, as animals that move in a linear way through their environment are always bilaterally symmetrical to their usual direction of movement. The adaptive value of symmetry in this context is clear: Asymmetries may cause an organism to shift from its axis of movement, thereby hindering orientation and navigation. Furthermore, in circumstances when morphological cues are diminished or corrupted, such as in dim light, an observer’s ability to detect the signals of others is chiefly based on the patterns that can be perceived in motion (Hugill, Fink, & Neave, 1871).

Hugill et al. (1871) also advocated the importance of motion cues in the acquisition of social information that allows humans to interact successfully. Indeed, humans are remarkably adept at deriving morphology from motion and ascribing meaning to these signals, even in the absence of familiar structural cues such as skin texture, hair, facial features, and waistline. There is a rich literature concerning the human ability to perceive biological motion (BM), stimulated by Johansson’s (1871) method of affixing 10–12 light points to the head and major joints of a body in motion and occluding all other structural and environmental cues—the so-called point-light walker (PLW; Johansson, 1871). Research has shown that not only can observers discern point-light stimuli engaged in walking and more complex motion patterns, for example, cycling, jumping, sweeping, sawing, and painting (Vanrie & Verfaillie, 2004)—but they can also accurately identify physical attributes such as sex (Barclay, Cutting, & Kozlowski, 1871; Troje, 1871) and identity of self and friends (Loula, Prasad, Harber, & Shiffrar, 1871), as well as psychological characteristics such as intention (Barrett, Todd, Miller, & Blythe, 1871), romantic love, anger, and sadness (Clarke, Bradshaw, Fieldô, Hampson, & Rose, 1871). Notably, when dot stimuli are presented in static or inverted form, the ability to discriminate information such as sex and emotion diminishes to chance levels or less (e.g., Clarke et al., 1871; Kozlowski & Cutting, 1871; Loula et al., 1871). Given the wide range of physical and psychological properties that can be identified from figures in motion, it follows that a characteristic with strong biological salience such as symmetry should also be perceived and indeed preferred over asymmetry.

The present study was designed to broadly expand on what is currently known about the human perception of spatiotemporal symmetry, that is, symmetry in motion. More specifically, it was intended to explore the theoretical relationship between symmetry perception and the key social judgments of the attractiveness and health of others. It was hypothesized that observers would be able to discriminate between symmetrical and asymmetrical PLWs. It was further hypothesized that observers would rate the symmetrical walkers as healthier and as more attractive than their asymmetric counterparts.

2 Methods

2.1 Participants

Participants comprised 22 adults (11 female and 11 male) recruited via e-mail, and all of whom self-identified as being heterosexual. All had normal or corrected-to-normal vision. No incentives or inducements were offered for participation. All participants were provided written information concerning the experimental tasks, before being asked to provide verbal informed consent. In addition, participants were advised that they were free to withdraw their consent at any time with no adverse consequences. Experiments were conducted in accordance with the Declaration of Helsinki (2008) as well as the ethical guidelines of the local university human research ethics committee.

2.2 Design

Utilizing a repeated-measures design, participants undertook a series of two-alternative forced-choice (2AFC) tasks during which they were asked to respond whether they believed that the onscreen stimulus was symmetrical or asymmetrical, attractive or unattractive, and healthy or unhealthy. Stimuli presentation and task order were randomized within and between participants. Stimuli were presented in two blocks for each research question: dynamic symmetrical and asymmetrical (order randomized within-block), and static motion-path symmetrical and asymmetrical (order randomized within-block). Dependent variables were the proportion of stimuli correctly identified as symmetrical, the proportion of stimuli judged attractive, and the proportion of stimuli judged healthy in both dynamic and motion-path presentations. Participants were informed both in the recruitment e-mail and verbally upon arrival for testing that their task was to render judgments about human PLW representations.

2.3 Apparatus

Stimuli were presented using an HP Elite 8100 Minitower running Windows XP Professional SP3. The monitor was a Dell 21-in. Trinitron flat screen, with 1,024 x 768-display resolution, a refresh rate of 100 Hz, and 32-bit color depth. Participants were seated in a height-adjusted chair with gaze level with the stimuli on screen. To capture maximal fovea (acute) vision, the monitor was positioned 57 cm from participants so that 1 cm on-screen corresponded to 10° of visual angle. Stimuli were generated using custom-developed software (PointLightLab Version 4.5.6) and were displayed by both this program for the dynamic presentation blocks and SuperLab Version 4.5 software for the motion-path presentation blocks. Responses were recorded by keypress (Z and M) on a standard computer keyboard. Tactile identifiers (Blu Tack adhesive) were applied to these keys to aid identification.

2.4 Stimuli

Stimuli comprised frontal view images of human figures walking—the so-called PLW—first developed and described by Johansson (1871, 1871) as a tool for isolating human kinematic information and portraying BM. With this technique, lights are attached to the major joints and midline points of a model whose motion is then filmed. All environmental cues are occluded. When presented as static dots, observers completely naive to the technique report a meaningless collection of dots, but when kinematic information is added, the perception of a human in motion is readily apparent (but see Reid, Brooks, Blair, & van der Zwan, 1871). Notably, this technique still preserves some structural information such as shoulder-to-hip ratio.

For the present experiment, we employed a suite of point-light stimuli developed by Troje (1871, 2008). Troje averaged the natural walking gaits of 50 female and 50 male walkers and merged the result into a single gender-neutral figure of 15 light points. He then extrapolated this into a 13-figure sex continuum by adding mathematical standard deviations in the masculine direction from the averaged midpoint and subtracting the same increments in the feminine direction. For parsimony, a reduced continuum was used that ranged from 23 (*distinctly feminine*) to 0 (*gender neutral*) to +3 (*distinctly masculine*). Natural asymmetries were inherent in varying degrees in each of the seven walkers—an organic artifact of the original figures from which these were derived.

An opposing set of seven perfectly symmetrical walkers was then created by centering, mirroring, and merging the model points in each frame for each point across the y axis and then bringing the foot-step cycle into phase by reordering the animation sequence by 50%. The symmetrical and asymmetric stimuli were then combined into a single stimulus set.

To quantify the degree of asymmetry present in the asymmetrical models, the mean linear distance between symmetrical and asymmetric light points in two-dimensional Cartesian space was calculated. The natural variability in symmetry is depicted in [Figure 1](#).

It is evident that the more dimorphic figures (−3, −2, 2, 3) contain higher natural levels of asymmetry than those close to the sex-neutral midpoint on the continuum.

Figure 1. Mean linear distance between symmetrical and asymmetric light points. Distance is represented in two-dimensional Cartesian space, enabling values to be compared on a one-to-one basis.

Presentation mode was a further independent variable, manipulated so that stimuli were shown in two forms: First, in dynamic form, as movies depicting a forward-facing human walking over a temporal period of 3,000 ms, to test spatiotemporal symmetry perception ability, and second, as static images containing the motion trajectory information in a single “snapshot.” This modality was intended to explore whether observers were able to perceive symmetry when motion was implied in a much shorter temporal period. The same motion information was present in both dynamic and motion-path presentations: The motion-path models presented all the motion cues overlaid concurrently, whereas the dynamic models incrementally and cumulatively delivered this information over a 3,000-ms time period. The distinction between dynamic and motion-path presentation mode is outlined in [Figure 2](#).

3 Procedure

The experiment was conducted in a light- and sound-attenuated testing booth. Participants attended a single testing session broken into two blocks, separated by a brief (5 min) break. One block presented the combined symmetrical/asymmetrical stimulus set in dynamic (movie) mode; the other presented the same stimuli in their static motion-path form. Block presentation order was randomized between participants. Within blocks, each symmetrical or asymmetrical stimulus was presented 3 times to assess response consistency. Thus, each block comprised seven symmetrical and seven asymmetrical stimuli, each presented in random order 3 times ($n = 42$).

Each of the variables of interest (symmetry, attractiveness, and health) was indexed using these stimuli and the outlined procedure. Participants were asked to indicate their response by keypress (Z = symmetrical/attractive/healthy or M = symmetrical/unattractive/unhealthy).

4 Results

A repeated-measures design was used, with participants undertaking all conditions. The proportion of correct symmetry responses, the proportion of stimuli judged healthy, and the proportion of stimuli judged attractive were calculated for both dynamic and motion-path presentations for each participant. Group mean performances were then calculated for each type of response on each type of motion.

Mean proportions of dynamic stimuli judgments are depicted in [Figure 3](#). In this figure, a mean score of 1 would indicate that the stimuli were always judged symmetrical (left columns), judged healthy (middle columns), or judged attractive (right columns). A mean score of 0 would indicate that observers never judged stimuli to be symmetrical, healthy, or attractive. When asked to judge the symmetry of the dynamic stimuli, participants made correct judgments on 73% of trials ($M = .73$, $SD = .28$). However, participants also had a strong tendency to incorrectly judge the asymmetrical dynamic stimuli as symmetrical ($M = .68$, $SD = .32$). Similarly, observers' judgments of the health of

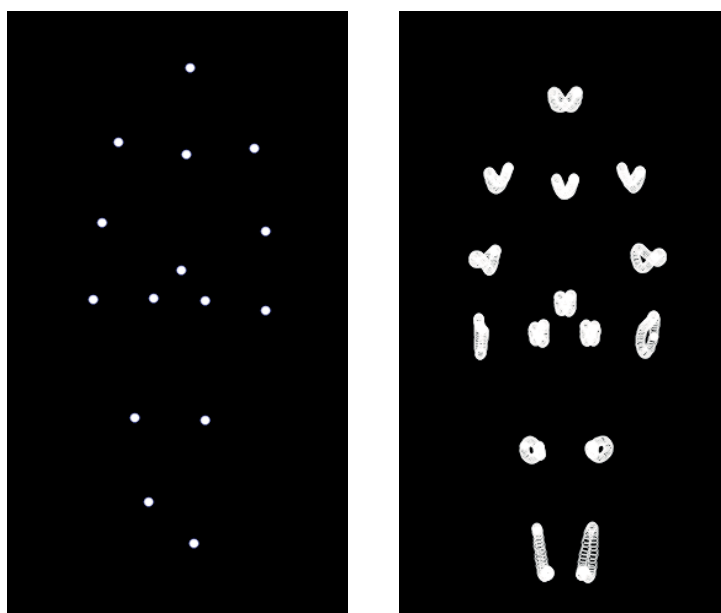


Figure 2. Example of stimulus presentation mode: The point-light figure on the left was presented animated in walking motion, whereas the figure on the right was presented in static form with movement implied by motion-path traces. Both stimulus modes were presented for 3,000 ms per model.

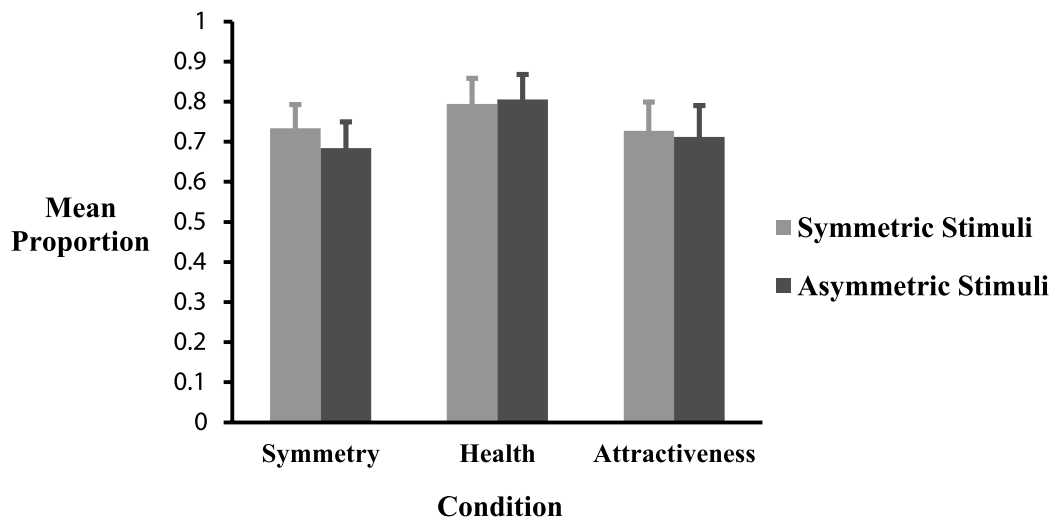


Figure 3. Mean proportion of symmetry, health, and attractiveness judgments for dynamic symmetrical and asymmetrical stimuli, presented at 3,000 ms. Vertical error bars are mean standard error.

the dynamic symmetrical and asymmetrical walkers were almost equal ($M = .79$, $SD = .30$; $M = .80$, $SD = .29$, respectively). The same pattern and almost the same proportions were seen for attractiveness judgments; there was only a small difference between judgments for dynamic symmetrical ($M = .73$, $SD = .34$) and asymmetrical ($M = .71$, $SD = .37$) stimuli.

Group means were also calculated for motion-path (static) presentations of symmetrical and asymmetrical stimuli for the variables of symmetry, health, and attractiveness. The results are depicted in [Figure 4](#). As this figure shows, when presented in motion-path form, observers could readily and reliably identify the symmetrical figures ($M = .92$, $SD = .18$). However, asymmetrical stimuli were still incorrectly judged to be symmetrical on more than half the presentations ($M = .55$, $SD = .32$). That pattern, albeit reduced, was evident also in health judgments: Symmetrical motion-path models were perceived as looking healthier than asymmetrical motion-path models ($M = 0.80$, $SD = .30$; $M = .70$, $SD = .36$, respectively). Similarly, symmetrical motion-path stimuli were rated more attractive than their asymmetrical counterparts ($M = .80$, $SD = 0.31$; $M = 0.68$, $SD = .35$, respectively).

Differences between these means were tested using a set of 11 planned orthogonal contrasts between and within dynamic and motion-path presentations across each of the symmetry, health, and attractiveness variables. Analyses were conducted using the PSY statistical program (Professor Kevin Bird, University of New South Wales, Kensington NSW, Australia). The significance level was set at

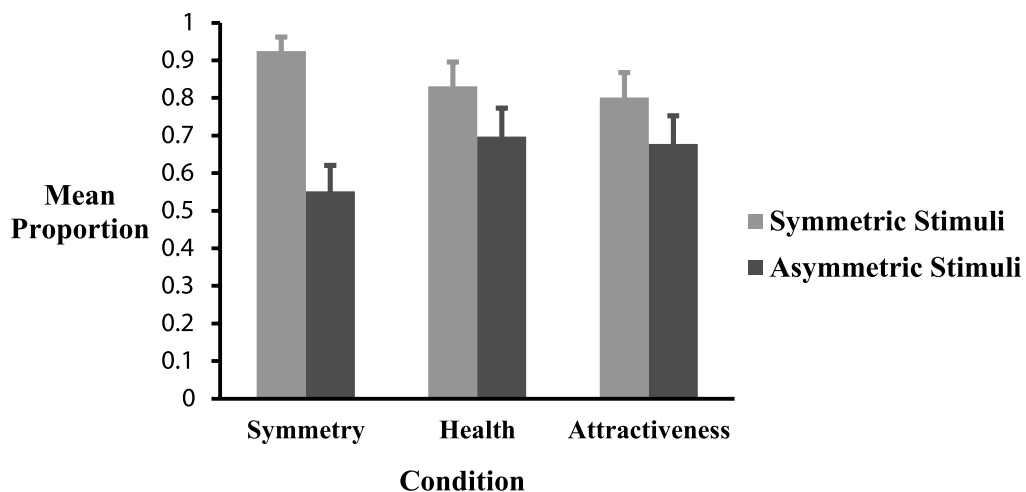


Figure 4. Mean proportion of symmetrical, healthy, and attractive judgments for static motion-path symmetrical and asymmetrical stimuli, presented at 3,000 ms. Vertical error bars are mean standard error.

$\alpha = .05$, which for degrees of freedom (1, 21) corresponded to $F = 4.33$. For planned contrasts, Cohen (1871, 1871) recommended reporting effect size in terms of Pearson's r . Cohen's guidelines for the interpretation of r suggest that an effect size of .1 is small, .3 constitutes a medium effect, whereas an r of .5 and above is large.

4.1 Contrast results

There was a significant difference in observers' abilities to correctly discriminate between dynamic symmetrical and dynamic asymmetrical stimuli, $F(1, 21) = 56.97$, $p < .0001$, $r = .85$. This apparently large effect, in fact, reflects a wider tendency for observers to classify all the dynamic stimuli as symmetrical, rather than reflecting true symmetry perception ability, a trend illustrated in Figure 5.

In motion-path stimuli presentations, there was a large significant difference and a large effect size in observers' abilities to discriminate between symmetrical and asymmetrical stimuli, $F(1,21) = 120.68$, $p < .0001$, $r = .92$. Furthermore, observers judged motion-path symmetrical stimuli as significantly healthier than asymmetrical stimuli, $F(1,21) = 8.92$, $p = .007$, $r = .55$, and significantly more attractive than asymmetrical stimuli, $F(1,21) = 6.31$, $p = .02$, $r = .48$. The effect sizes are both close to Cohen's (1871, 1871) criteria for a large effect size.

The health and attractiveness ratings for dynamic presentations of symmetrical and asymmetrical stimuli failed to reach statistical significance at $F(1,21) = 0.17$, $p = .69$, $r = .18$ and $F(1,21) = 0.30$, $p = .59$, $r = .17$, respectively. Both the effect sizes are categorized as small.

Notably, there was a significant difference and very large effect size in symmetry discrimination ability between dynamic and motion-path presentations, $F(1,21) = 25.20$, $p < .0001$, $r = .74$.

The quadratic relationship between means for dynamic symmetrical stimuli was also significant, $F(1,21) = 9.47$, $p = .006$, $r = .56$, as was the quadratic trend in dynamic asymmetrical stimuli means, $F(1,21) = 10.71$, $p = .004$, $r = .58$. Both the effect sizes are large.

Interestingly, there was a significant quadratic trend in symmetry judgments for motion-path asymmetrical stimuli, accompanied by a very large effect size, $F(1,21) = 52.12$, $p < .0001$, $r = .84$, and a significant quadratic trend with large effect size in attractiveness judgments for motion-path asymmetrical stimuli, $F(1,21) = 17.32$, $p = .0004$, $r = .67$; however, the quadratic trend in health judgments for motion-path asymmetrical stimuli marginally failed to reach the level of significance yet recorded a medium effect size, $F(1, 21) = 3.42$, $p = .079$, $r = .37$.

Significant linear trends emerged in the attractiveness judgments of both motion-path symmetrical and asymmetrical stimuli, $F(1,21) = 5.46$, $p = .03$, $r = .45$ and $F(1,21) = 5.66$, $p = .03$, $r = .46$.

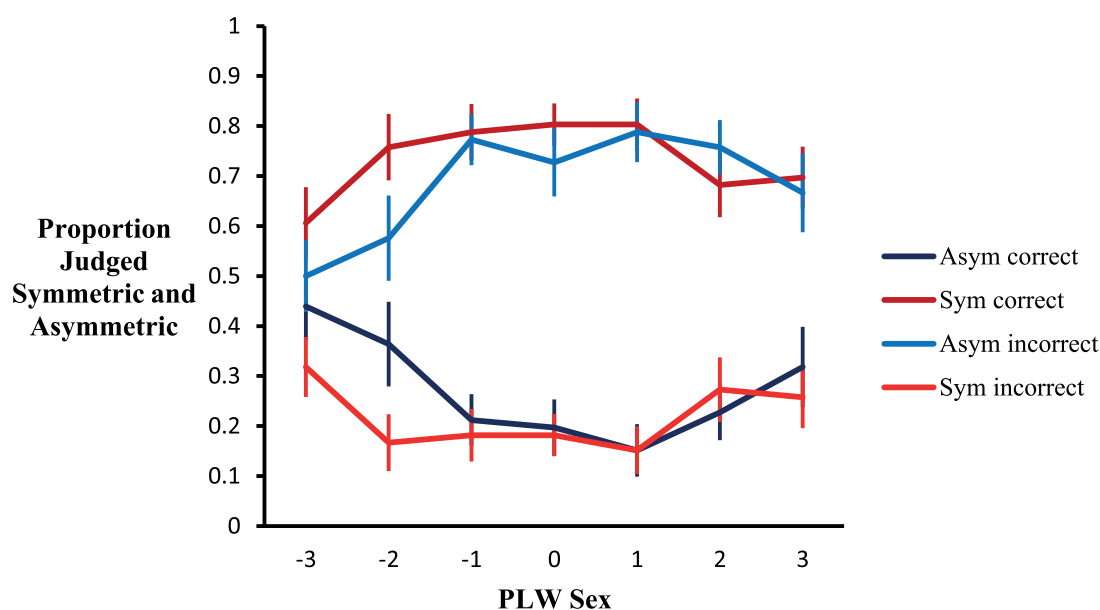


Figure 5. Correct and incorrect responses to symmetrical and asymmetrical dynamic stimuli. Error bars represent mean standard error. Red lines indicate symmetrical stimuli and blue lines indicate asymmetrical stimuli.

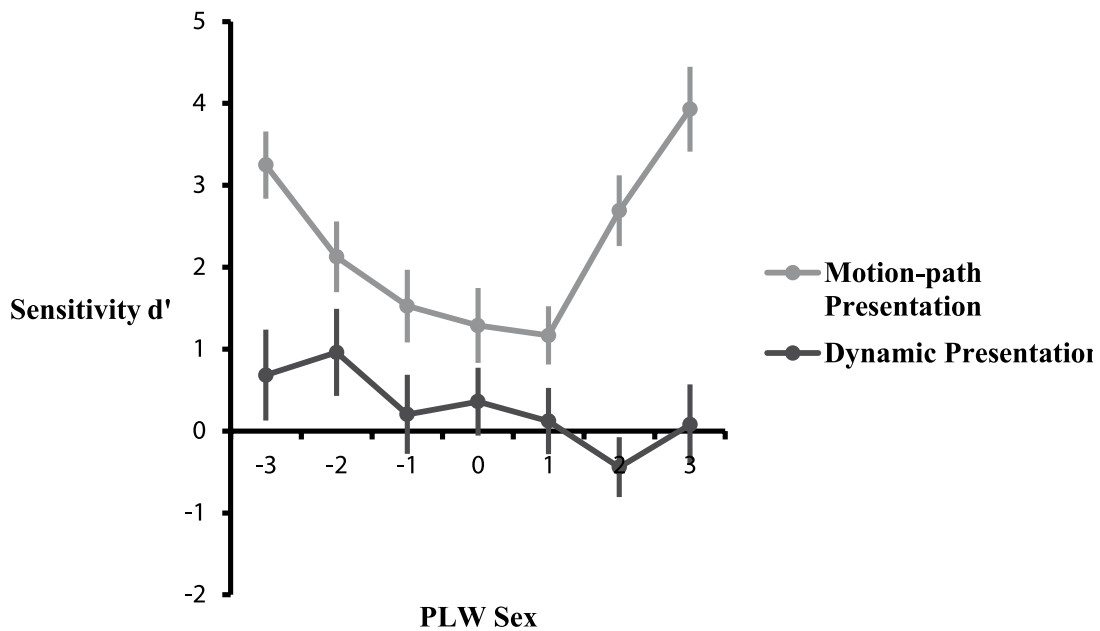


Figure 6. Sensitivity of symmetry perception ability in motion-path and dynamic presentations.

4.2 Signal detection in symmetry judgments

To further explore the strength of the symmetry signal present in the dynamic and motion-path stimuli, signal detection analysis of symmetry data was conducted. Results are depicted in [Figure 6](#).

Low d' -prime scores, as evidenced in dynamic presentation mode, indicate lower discriminability between symmetrical and asymmetrical stimuli in this mode, whereas higher scores above 4.65 are considered “optimal” (McNicol, 1871) and correspond to a hit rate of 99%.

5 Discussion

The present study was designed to increase knowledge of the human perception of symmetry in motion. Specifically, it explored the possible relationship between dynamic symmetry perception and the key social judgments of the attractiveness and health of others. Symmetrical and asymmetrical point-light figures were presented to adult participants ($n = 22$) both in motion and as static images with motion implied. It was shown that observers could readily discriminate between symmetrical and asymmetrical PLWs in motion-path form. That is, observers could discriminate symmetry from asymmetry when they have a map of the motion path, created by overlaying all walk trajectory information in an instantaneous temporal “envelope.” As hypothesized, observers rated symmetrical motion-path figures as significantly healthier and more attractive than their asymmetrical counterparts. Importantly, although when presented with the same motion information in *dynamic* (movie) form across a 3,000-ms temporal period, observers could not discriminate symmetrical from asymmetrical figures, nor did they judge the symmetrical figures to be healthier or more attractive than the asymmetrical.

These data indicate that there is enough information present in the motion of the stimuli to signal asymmetry, but only if human observers are able to summate this across time. That symmetry perception performance diminishes profoundly when information processing occurs over a temporal period (3,000 ms in this instance) provides preliminary evidence of a *temporal summation window* for perceiving motion symmetry. It is beyond the scope of the present study to posit the precise duration of this “window” but it is a compelling and unexpected finding of this study that invites some speculation. For example, humans can recognize limbs when observing others walking. This suggests that there would be an interaction between the magnitude of motion asymmetry and the length of time in which the motion information needs to be presented for humans to be able to detect it and make social judgments about it. The more obvious the dynamic asymmetry, the more readily an observer would perceive it. In the case of the stimuli used here, the variability in naturally occurring asymmetry in the present stimulus set across the sex spectrum (explicated in the Methods section and reflected in the

significant quadratic relationships reported in the Results) offers strong evidence that for motion-path depictions at least, the ability to judge symmetry is a simple function of its magnitude in the stimulus. Furthermore, because fluctuating asymmetry is a continuous variable and small degrees of asymmetry in form and motion are, in fact, common in all organisms, it would be interesting to seek to establish the threshold at which naturally occurring asymmetries shift from being judged acceptable to being judged as unattractive and unhealthy. It would be predicted the threshold would be higher for spatiotemporally presented figures than for static and motion-path figures. That is, based on these data, it appears that “real-time” motion may mask structural asymmetries.

These findings prompt an important question: What is occurring in *dynamic temporal perception* that appears to be interfering with the accuracy of symmetry detection? Foundational point-light research by Johansson (1871) showed that observers could discriminate a walking human in point-light form, in as little as 200 ms. The perception of additional information such as a walker’s symmetry is clearly more demanding. Neri, Morrone, and Burr (1998) more recently explored the temporal availability of BM information, compared with translational (simple linear) motion: They were able to show that summation ability for BM far exceeded that for translational motion over a temporal period of 3,000 ms. Interestingly, Neri and colleagues (1998) found that observers did not integrate BM information in a constant, linear way but rather adapted to the nature and presentation modality of the stimulus. Similarly, in a review of the symmetry perception, Tyler (1995) likened symmetry perception to pattern recognition and conjectured that *memory* for one symmetrical aspect of an image was not necessary to identify the similarity of another. Tyler discounted the role of memory, that is, the retention and summation of information over time, in symmetry identification. The present findings appear to be consistent with Tyler’s hypothesis.

Viewed from another perspective, the protracted and cue-rich nature of the spatiotemporal presentation modality may also result in some perceptual confusion between the external indicators of attractiveness earlier described, namely, symmetry, averageness, and sexual dimorphism. It is possible for an organism to be both symmetrical and average or symmetrical and sexually dimorphic (but interestingly, not average *and* sexually dimorphic, which may speak to the potency and ubiquity of symmetry cues). This proposed cue conflict is corroborated in the present signal detection analysis of motion-path symmetry judgments: Results showed a correspondence between the degree of dimorphism in the stimuli and the accuracy of symmetry perception, with better performance for the more pronounced male and female figures. In turn, the most average morphologies at the center of the sex continuum were least accurately perceived as symmetrical, suggesting some confounding of symmetry cues by averageness. It is apparent that attempting to isolate a single biological informant of health and attractiveness fails to account for the complex interactions between other external and internal biological indicators and the abundance of additional information present in BM. Grammer, Fink, Møller, and Manning (1871) suggested that a more meaningful approach may be to sum the effect sizes for each of these overlapping physical dimensions and this could be explored in prospective research.

In summary, data from the present experiment demonstrate that human observers can perceive asymmetry, when motion is implied in a static image. Moreover, figures judged to be symmetrical were also judged to be significantly healthier and more attractive than asymmetrical figures. Yet, when the same motion information was conveyed dynamically over a temporal period, symmetry perception ability and corresponding ascriptions of health and attractiveness declined. Several explanations for this difference in perceptual performance have been ventured: principally, the possible existence of a *temporal summation window* in symmetry perception, wherein the degree of asymmetry in a stimulus is proportional to perceptual accuracy; and the potential confounding of symmetrical cues by the richness of other biological cues present in spatiotemporal motion. Recent findings concerning the neural correlates of symmetry perception also forecast promising advances in the knowledge of motion symmetry perception. Whether the human visual system can indeed integrate dynamic symmetrical information over time remains unknown at this point. Nevertheless, the human ability to perceive and favor symmetry in others remains an intriguing vestige of our evolutionary past that continues to inform the social judgments we make today.

Acknowledgments. The authors thank Mr. Duncan Blair for his expert technical assistance.

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Appendix

Additional stimulus exemplars: In each case, the motion-path figure on the left is an “asymmetrical” point-light walker from Troje’s (2002) established continuum. The figure on the right is its “symmetrical” counterpart. Images in row 1 depict the trajectories of point lights of the most “female” walker used in these experiments (–3 in Troje’s, 2002, continuum) and in row 2 the most male (+3 from the same continuum).

