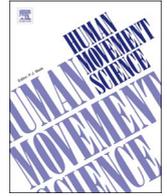




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Walking my way? Walker gender and display format Confounds the perception of specific emotions

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ABSTRACT

Previous evidence has shown that males and females display different gait kinematics which may influence the perception of emotions displayed through the same walking gait. We therefore investigated the influence of walker gender on the perception of happiness, sadness, anger and fear displayed through walking movements. Full-light (FL), point-light (PL) and synthetically modelled point-light walkers (SW) of both genders were shown to perceivers over three experiments. Additionally, gender ambiguous synthetic walkers were shown to control for the influence of form, gender stereotypes and idiosyncratic gait movements on emotional gait perception. Each emotion was identified above chance level for both walker genders and in all display conditions though significantly less in PL and SW than in FL. The gender of the walker did not influence the pattern of identifications in FL walkers (Fear > Sad > Happy > Anger > Neutral), but did influence the identification patterns in PL (*Female*: [Happy = Sad = Fear = Anger] > Neutral; *Male*: Fear = Sad = [Happy > Anger] > Neutral) and SWs (*Female*: Happy = Sad = Anger = Fear = Neutral; *Male*: [Happy = Sad = Anger] > [Fear = Neutral]; *Ambiguous*: [[Happy = Sad = Anger] > Fear] = Neutral). The gender of the walker and format in which they are displayed influenced the perception of different basic emotions. The constructed SW stimuli also displayed happiness, sadness and anger with equivalent intensity in female, male and gender ambiguous walkers thus untangling the perception-expression entanglement that has plagued previous emotion perception research.

1. Introduction

A person's emotional state displayed through their walking movements has the potential to be perceived from a distance before facial expressions are visible. The perceiver is then able to decide whether to approach the individual out of friendship or avoid them out of caution. There is good evidence that specific emotions can be perceived through facial expressions (Goos & Silverman, 2002; Marsh, Adams, & Kleck, 2005; Vaughn Becker, Kenrick, Neuberg, Blackwell, & Smith, 2007), bodily movement (Atkinson, Dittrich, Gemmell, & Young, 2004; Darwin, 1872/1999; Dittrich, Troscianko, Lea, & Morgan, 1996) and, more specifically, walking gait (Chouchourelou, Matsuka, Harber, & Shiffrar, 2006; Heberlein, Adolphs, Tranel, & Damasio, 2004; Karg, Jenke, Kuhnlenz, & Buss, 2009; Montepare, Goldstein, & Clausen, 1987; Roether, Omlor, Christensen, & Giese, 2009; Zibrek, Hoyet, Ruhland, & McDonnell, 2015) but it is not clear how well each emotion is perceived relative to other displayed emotions. Furthermore, it is not clear how the perception of emotion through walking gait is confounded by display variables and walker gender.

Few studies have directly investigated how different emotions are relatively perceived through walking style. Montepare et al.

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(1987) found that perceivers could accurately identify four emotions (happiness, sadness, anger, and pride) from walking style. Happiness, sadness and anger were identified equivalently whilst pride was identified significantly less than sadness and anger. The authors argued the perception of pride was of less ecological importance (McArthur & Baron, 1983) than the perception of the other emotions thus perceivers had more difficulty identifying proud gaits. However, adopting such an ecological perspective assumes that any differences in the perception of the various emotions is a result of perceptual bias motivated by individual-specific affordances.

Alternatively, relative differences in the ability to perceive various emotions may be due to contrasting gait kinematics in the displays of the various emotions. Roether, Omlor, Christensen, and Giese (2009) investigated emotional gait perception and expression by walkers. They used motion capture techniques to create 3-dimensional geometric walker stimuli that expressed happiness, sadness, anger, fear and a neutral baseline through their gait kinematics. The walker figures were constructed by overlaying cylinders (trunk/neck), spheres (head/joints) and ellipsoids (limbs/shoulders/hips) on the motion captured data of real actors. The geometric walkers controlled for the possible influence of body composition (e.g. explicit gender attributes, body attractiveness, muscle composition) thus making them an improvement upon the full-light walker stimuli used by Montepare et al. (1987). Perceivers identified each expressed emotion relatively well (i.e. happiness: 75.1%, sadness: 89.8%, anger: 70.3%, and fear: 77.1%) with sad walkers identified the most accurately and angry walkers identified the poorest. More detailed analysis of the confusion matrices revealed that happiness was consistently confused with anger (and vice versa) as was sadness with fear. Analysis of the movement features of each emotionally expressive gait revealed that happy and angry walks were characterised by larger faster movements whilst sad and fearful walks were characterised by smaller slower movements. Furthermore, Roether et al. (2009) found that when a neutral gait was sped up or slowed down to match the walking speed of an emotion-specific gait (e.g. anger), then the neutral gait was misidentified as expressing the speed-matched emotion (i.e. anger) in over half of the stimuli (chance level 25%) suggesting that perceivers may be able to identify emotionally expressive gaits from kinematic information alone.

The 3-dimensional geometric walkers created by Roether et al. (2009) maintained both the kinematic gait information specific to each emotion and a visible structure with which to perceive dynamic joint angle information. Observable dynamic joint angles may act as a visual cue with which perceivers can discern kinematic information (e.g. velocity of lower leg relative to the upper leg). By reducing the emotional walker stimuli further to point-light (PL) display, the perceivers are deprived of access to most structural information (Cutting, Proffitt, & Kozlowski, 1978; Johansson, 1973) thus forcing them to perceive the displayed emotion through gait kinematics alone. Since Johansson's (1973) first use of PL display, it has been shown that emotions can be perceived through PL displays of dance (Dittrich et al., 1996) and door knocking movements (Pollick, Paterson, Bruderlin, & Sanford, 2001). It stands to reason that different emotions can also be perceived from PL displays of walking gait albeit less accurately than FL walkers due to a reduction in stimulus information.

The gender of the observer and the observed has long been known to influence the perception of emotional expressions (Cutting et al., 1978; Johnson, McKay, & Pollick, 2011; Kret & de Gelder, 2012) however, these biased perceptions can be rooted within several different perceptual mechanisms. Gender-specific structures of the face and body can bias the perception of the expressed emotion. Male faces have several architectural structures that are different from female faces (e.g. lower brow, squarer jaw, Bruce et al., 1993), whilst male bodies typically have wider shoulders and narrower hips than female bodies (Cutting et al., 1978). Marsh et al. (2005) found that perceivers identified more mature faces as expressing angry expressions whilst more neonatal faces were identified as expressing fear, thereby suggesting that the hardening of facial structure, due to the developmental growth towards adulthood, may be associated with anger and possibly dominance. Vaughn Becker et al. (2007) found that anger was perceived faster and more accurately on male faces whilst the perception of happiness was facilitated on female faces. The findings of both Marsh et al. and Vaughn-Becker et al. suggest that the perception of anger is facilitated when expressed by males whilst the perception of happiness and fear are facilitated in female expressions. However, facial expressions and bodily movements activate distinct brain systems (Buccino et al., 2001) thus the findings from past emotional perception studies using facial expressions may not generalise across to the current study on emotional perception from walking gait.

Nonetheless, gender effects on emotion perception/expression may be entrenched in stereotypical beliefs and/or ecological advantage (Condry & Condry, 1976; Fabes & Martin, 1991; Johnson et al., 2011; Plant, Hyde, Keltner, & Devine, 2000; Seidel, Habel, Kirschner, Gur, & Derntl, 2010; Zibrek et al., 2015). For example, there is a stereotypic belief that males are angrier than females (Kret & de Gelder, 2013; Plant et al., 2000; Zibrek et al., 2015) thus a perceiver may bias their perception of the displayed emotion towards anger if they identify the walker as male. In their extensive literature review, Kret and de Gelder (2012) identified that past emotion perception/expression findings tended to be inconsistent across studies nevertheless, they concluded that generally females tended to be better at perceiving and expressing most emotions, whilst males tended to perceive anger/aggressive expressions better. Kret, Pichon, Grèzes, and De Gelder (2011) also showed that male and female observers utilise different neurological networks when perceiving different emotions as expressed by either gender, thus different emotional perception processes are activated for gender congruent and incongruent dyads. Furthermore, Goos and Silverman (2002) found that male perceivers were more sensitive to the perception of anger in male faces, whilst female perceivers were more sensitive to anger on female faces, thereby suggesting that intra-gender competition possibly influences the perception of threatening affect in others. Theoretically, this facilitation of intra-gender emotion perception could be explained as shared representations (Bidet-Ildai, Chauvin, & Coello, 2010; Calvo-Merina, Glaser, Grèzes, Passingham, & Haggard, 2005), thereby suggesting that the findings of emotional perception from facial expressions may be robust to emotional bodily expressions as well.

However, perceivers are also able to identify the sex and the gender of a walker based on the kinematic information inherent in PL display (Cutting et al., 1978; Kozlowski, Brooks, & van der Zwan, 2016; Troje, 2002). The perception of an emotion may be biased towards a specific gender due to similar kinematics in the display of gender and the display of a specific emotion (Atkinson et al., 2004; Halovic & Kroos, 2009; Troje, 2002). For example, males, relative to females, walk with greater lateral sway with their elbows

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