

# Facilitating the Perception of Anger and Fear in Male and Female Walkers

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**Abstract.** Previous evidence has indicated that the perception of emotions in others is confounded by the gender of the person displaying the emotion. This confound may be conceptually based or structurally/kinematically based. Male and female full-light (conceptual and kinematic information) and point-light walkers (kinematic information) displaying either anger or fear were shown to perceivers. Perceiver identification times were recorded. Results indicate the perception of fear is facilitated if the walker displaying fear is female due to similar kinematics for fearful gait and female-specific gait.

## 1 INTRODUCTION

There is good evidence that specific emotions can be perceived through walking gait [1, 2, 3]. Furthermore, past studies have inferred that the speed in which perceivers can identify each emotion indicates the relative ease in identifying those emotions [4, 5, 6]. However, the gender of the walker likely influences the perception of different emotions due to gender-emotion stereotypic beliefs [7, 8] or due to overlapping kinematics between specific emotion expression and gender-specific gait [9, 10].

The relationship between emotionality and gender is inherent in our culture and represented in the majority of theories on emotional development [11, 12, 13]. In the classic study by Condry and Condry [14], an emotional display by an infant labelled ‘girl’ was rated by perceivers as less angry and more afraid than the same display labelled ‘boy’. In addition to the stereotypic beliefs of each gender expressing specific emotions there is the belief that females experience and express emotions more frequently and with more intensity than males [7, 8]. The perception of emotions and the gender of the person displaying the emotion appear to be confounded on a conceptual level.

In contrast, this confounded relationship may be due to structural or kinematic similarities between specific emotion expression and the display of gender. The structural architecture of a gender-specific face has been shown to influence the speed in which specific emotions can be identified. Vaughn Becker, et al. [6] found that anger was identified faster and more accurately on male faces than female faces. Also, happiness was identified faster and more accurately on female faces. Male faces have several architectural

structures that are different to female faces. Male faces tend to have a lower brow and a squarer jaw whilst female faces retain some of the neonatal features of children [15]. The structural architecture of a male face is similar to the facial expression of anger in which the lowered brow and squarer jaw mimics the furrowing eyebrows and clenching jaw of angry expressions. In contrast, the neonatal structure of a female face is similar to the facial expression of happiness in which the finer jaw line, less prominent brow and rounder cheeks mimic the upturned facial characteristics of the expression of happiness [16, 17, 18, 19]. It is therefore not surprising that perceivers are biased towards perceiving anger in male faces and happiness in female faces.

However, walking is clearly different to facial expressions and the perception of different emotions from facial expressions uses a different brain system to that used for the perception of emotions through bodily movement [20]. Thus previous findings may not generalise to cover the expression and perception of emotions through walking style. However, the gender of a walker is likely to still influence the perception of different emotions through walking style because males and females have distinct walking styles [10].

Any specific emotion that is expressed through gait movements that are similar to a gender specific walking style are likely to bias the perception of that emotion towards the gender of the walker. Troje [10] found that male-specific gait increased the walker’s perceptual size (i.e. greater lateral sway of the body and with outward pointing elbows) whilst female-specific gait incorporated size reducing kinematics (i.e. smaller steps with backward pointing elbows). The size enhancing kinematics of male gait appears to make the walker look more dangerous therefore more likely to be perceived as displaying anger [9]. On the other hand the size reducing kinematics of female gait is similar to the cowering movements of fear [9] thus this is likely a bias towards perceiving fear when the walker is female. Therefore there is a likely confound between gender-specific gait and the perception of emotions.

The aim of this research is to investigate the influence of walker gender on the perceiver reaction time for identifying the emotions anger and fear. We therefore hypothesise: 1) Perceivers will identify anger faster when the walker is male compared to female. 2)

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Perceivers will identify fear faster when the walker is female compared to male.

## 2 Stimulus Construction

### 2.1 Method

#### 2.1.1 Participants

The walkers were 17 female and 19 male actors (Age:  $M = 32.5$ ,  $SD = 9.8$ ; years of acting training:  $M = 2.46$ ,  $SD = 5.08$ ; years of acting experience:  $M = 4.18$ ,  $SD = 6.99$ ). The recording of gait movements with real felt emotions (i.e. induced) using motion capture methods is methodologically difficult to impossible. However, actors are trained to reproduce a displayed emotion instantly on demand without the need of an external emotion inducing event. The actors were recruited from various acting agencies in the Sydney area and through recruitment flyers and were paid \$50AUS for travel costs.

#### 2.1.2 Apparatus

Walkers wore black spandex body suits (ankle to wrist length) to ensure that perceivers could adequately see the walker's gait movements. All walkers wore a black balaclava, leaving only the walker's eyes and lips visible to the camera. To create point-light (PL) displays of the walkers, 17 visible Vicon infrared reflective markers were attached with double sided tape to both sides of the walker's body on the ears, shoulders, elbows, wrists, hips, knees, ankles, insteps of the feet and a single marker on the manubrium (Figure 1). The reflective markers were tracked within a 3-dimensional space with a Vicon (Oxford Metrics Limited) motion capture system with 10 cameras. PL displays of the walkers were created by importing the motion capture data into Matlab (The Math Works, Inc.). Full-light (FL) displays of walkers were simultaneously recorded with a digital camera (Panasonic NV-MX300EN/A) from a frontal perspective.



**Figure 1.** A FL walker shown with the corresponding Vicon markers used to create PL walkers.

#### 2.1.3 Procedure

Prior to recordings the walkers were informed that they were to walk whilst displaying different emotions (i.e. anger and fear<sup>2</sup>) and were given time to think about how to express each emotion. For each emotion, the actors were asked to walk from one side of the room to the other. Both emotions were recorded at three levels of emotional intensity, starting with low, progressing to moderate and then high to assist in the expression of each emotion. At least two complete gait cycles was recorded for each emotion/intensity combination of each walker.

## 3 Experiment 1: The Influence of Walker Gender on the Reaction Time for Identifying Specific Emotions in FL Walkers

### 3.1 Method

#### 3.1.1 Participants

The sample of 'perceivers' comprised 38 (34 female) first year psychology students from the University of Western Sydney. The sample had a mean age of 22.61 years ( $SD = 8.88$ ). All perceivers had normal or corrected to normal vision and were given course credit for their participation in the experiment.

#### 3.1.2 Materials

Due to technical faults during stimulus construction, some walkers failed to be recorded thus were not shown to perceivers. Perceivers were shown the remaining 187 FL walker stimulus items (anger = 93, fear = 94) with a minimum 30 examples of each emotion/intensity combination.

The experiment-control software Alvin (version 1.19, [21]) was used to show perceivers the FL walkers with an inter-stimulus interval of two seconds between walkers. The program displayed video clips of a walker walking towards the perceiver. It required the perceiver to click on 1 of 5 categorical buttons corresponding to the five displayed emotions (happy, sad, anger, fear, and neutral<sup>2</sup>) and automatically measured the time between the initial display of the FL walker and the mouse click on one of the categorical buttons.

#### 3.1.3 Procedure

Perceivers were told they would view a series of walkers shown in full video display format. It was explained that the walkers would be walking with one of five emotional states: happiness, sadness, anger,

<sup>2</sup>Five different emotions (i.e. happy, sad, anger, fear and neutral) were collected and tested in these experiments for other research purposes which are irrelevant to this paper. We will thus only report the details for the emotions anger and fear due to their relevance for the research questions investigated here.

fear or neutral and that they were required to identify which emotion the walker was feeling by clicking the button on the computer screen that corresponded to the emotion they perceived. Perceivers were also told to make their judgments as quickly and as accurately as possible and they need not wait until the end of the video clip to make their judgement.

### 3.2 Results

Only correctly identified emotions were included in these analyses thus ensuring any emotion/gender gait similarities, whether stereotyped or not, were valid displays of that individual emotion. Paired-sample t-tests were conducted comparing the perceiver reaction times of correctly identified emotions between both genders. The mean reaction times for each perceiver were used as the data scores for this analysis in order to reduce the high degrees of freedom. A Bonferroni corrected alpha of .025 was used for both t-tests. Fear was identified significantly faster in female walkers compared to male walkers,  $t(37) = 4.6, p = .000$ . There was no significant difference in the reaction time for identifying anger between male and female walkers,  $t(37) = 2.02, p = .050$ . Descriptive statistics are shown in figure 2.



**Figure 2.** Fear was identified significantly faster in female FL walkers than male FL walkers. Anger was identified in equivalent time in both female and male FL walkers.

### 3.3 Discussion

We found that perceivers identified fear faster in female walkers than in male walkers. There are two possible explanations for this finding. The first of which is that the size reducing kinematics of female-specific gait [10] is similar to the expression of fear [9] in walkers. The similarity between female-specific gait and the expression of fear likely facilitated the perception of fear in female walkers leading to faster reaction times for female walkers but not male walkers.

The second possible explanation for this finding is that the concept of a fearful individual is confounded with the perception of females. Females, due to their reduced stature, are physically less able to

defend themselves from assault than males, possibly explaining why females are more susceptible to experiencing fear than men [22, 8]. The perception of fear is therefore likely facilitated when the perceiver can identify the walker as female.

To distinguish between these two possible explanations we replicated this first experiment with point-light (PL) walkers. The gender of FL walkers is easily apparent to the perceivers. PL walkers, on the other hand, deny perceivers of most structural information thus making the gender of the walker increasingly difficult to perceive [23, 24]. The gender-specific kinematics of the walker however, are left undiminished [10]. If the concept of fear is confounded with the concept of female, then the findings of this experiment would not be reproduced in the next experiment with PL walkers. However, if the kinematics of fearful gait is confounded with the kinematics of female-specific gait then we would find similar results with PL walker stimuli.

## 4 Experiment 2: The Influence of Walker Gender on the Reaction Time for Identifying Specific Emotions in PL Walkers

### 4.1 Method

#### 4.1.1 Participants

The participant requirements were the same as in experiment 1. The sample comprised of 34 perceivers (19 female) first year and postgraduate psychology students and had a mean age of 26.71 years (SD = 5.61).

#### 4.1.2 Materials

Due to technical faults during stimulus construction, some walkers failed to be completely recorded (i.e. missing markers) thus were not shown to perceivers. Perceivers were shown the remaining 184 PL walker stimuli (anger = 100, fear = 84) with a minimum 27 examples of each emotion/intensity combination. For every walker the common translatory component of each marker was subtracted by performing a principal components analysis [25] in Matlab. The first principal component always represented the translation of the walker across the designated movement space. Therefore this component was excluded from a reconstruction of the remaining data based on all remaining components thus creating stationary walkers with the ecologically valid kinematics of a locomotive walker.

The procedure was identical to that used in the FL walker experiment.

### 4.2 Results

Two paired-sample t-tests were conducted in the same way as in the previous experiment. The mean reaction times for each perceiver were again used as the data scores for this analysis. A Bonferroni

corrected alpha of .025 was used for both t-tests. Both fear,  $t(32) = 4.7, p = .000$ , and anger,  $t(33) = 3.0, p = .005$ , were identified significantly faster in female walkers compared to male walkers. Descriptive statistics are shown in figure 3.

### 4.3 Discussion

Our finding that fear was identified faster in female walkers than in male walkers is congruent with the results of the previous experiment with FL walkers. This lends support to the argument that the kinematics of fearful gait is similar to the kinematics of female-specific gait thus facilitating the perception of fear in female walkers. The perception of fear in walkers is therefore confounded with the gender of the walker.



**Figure 3.** Fear and anger were both identified significantly faster in female PL walkers than in male PL walkers.

However, our additional finding that anger was also identified faster in female PL walkers is surprising. There is no kinematic similarity between anger-specific gait and female-specific gait [3, 9, 10]. One possible explanation for this finding is that the female walkers were more skilled at displaying both anger and fear through gait. Females experience and express their emotions more frequently and with more intensity than males [22] thus are likely to be more skilled at expressing their emotions through gait movements. The greater expressive skill of female walkers likely compounded the kinematic similarities between female-specific gait and fearful gait, further facilitating the perception of fear in female walkers in both FL and PL conditions. However, this argument does not explain why anger was identified faster in female walkers in the PL condition but equivalently the FL condition.

Conceivably, our initial argument for the confound between the perception of anger and male walkers had merit but was counteracted in the FL condition by the additional skill that female walkers had at expressing their emotions. However, unlike the kinematic similarities between fearful gait and female-specific gait, the influence of male gender on the

perception of anger in walkers appears to be conceptually based. That is, when perceivers could easily identify the gender of a male walker in the FL condition, they interpreted the emotion displayed by the walker in a stereotype-congruent manner [8]. This stereotype-congruent information facilitated the perception of anger in male walkers but this advantage was counteracted in the FL condition by the increased expressive skill of the female walkers.

However, when the gender of the walker was no longer so apparent in the PL condition, perceivers were denied the additional cue of stereotype-congruent information. The perception of anger in male PL walkers was therefore not facilitated. However, the greater expressive skill of female walkers did facilitate the identification of anger in the PL condition. Consequently, anger was identified faster in female walkers than male walkers in the PL condition but not in the FL condition.

### 5 Conclusion

We have provided support that the kinematics of fearful gait is similar to the kinematics of female-specific gait thereby facilitating the perception of fear in female walkers. We have also argued that male gender and anger are confounded on a conceptual level therefore when the gender of the walker is easily perceived as male then the perception of anger is facilitated. However, stronger conclusions could be made if these experiments were replicated with walker stimuli that was normalised for the level of expression. These findings have important implications for the development of anti-victimisation programs whereby women may be taught how to walk in a way that may discourage potential attackers.

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