SEX DIFFERENCES IN BODY LANGUAGE READING

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Abstract

Body motion is a rich source of information for social cognition. However, gender effects in body language reading are largely unknown. Here we investigated whether recognition of emotional expressions revealed by body motion is gender dependent. To this end, females and males were presented with point-light displays portraying knocking at a door performed with different emotional expressions. Our findings show that gender affects accuracy rather than speed of body language reading. This effect is modulated by emotional content of actions: males surpass in recognition accuracy of happy actions, whereas females tend to excel in recognition of hostile angry knocking. Advantage of women in recognition accuracy of neutral actions suggests that females are better tuned to the lack of emotional content in body actions. The study provides novel insights into understanding of gender effects in body language reading, and helps to shed light on gender vulnerability to neuropsychiatric impairments in visual social cognition.

Body language reading is of importance for adaptive social behavior and non-verbal communication. This ability constitutes a central component of social competence. Healthy perceivers are able to infer emotions and dispositions of others represented by point-light body movements that minimize availability of other cues (Atkinson et al., 2004; Ikeda & Watanabe, 2009; Pollick et al., 2001; Rose & Clarke, 2009). Perceivers can reliably judge emotional content of dance represented by a few moving dots placed on the dancer's body (Dittrich et al., 1996). Visual sensitivity to camouflaged point-light human locomotion is modulated by the emotional content of gait with the highest sensitivity to angry walking (Chouchourelou et al., 2006).

But how do we know whom to trust or who is attracted to us? Such judgments are vital to social interaction, and men and women appear to show profound differences in cues attended to. Yet research has been mainly limited to static face images. In accordance with widespread beliefs, females exhibit higher sensitivity to non-verbal cues: they better discriminate friendliness from sexual interest (Farris et al., 2008) and are more proficient in recognition of facial emotions (Montagne et al., 2005). As a rule, however, facial expressions and static body postures can only signal emotional states and affect, but do not provide information about how to deal with it. Dynamic body expressions and actions of others are richer ands more ecologically valid source of information for social interaction (de Gelder, 2009; Pavlova, 2009). Gender impact on body language reading is, however, largely unknown.

The present work intends to clarify whether, and, if so, how perceiver's gender affects recognition of emotional expressions conveyed by actions. More specifically, we ask (i) whether gender affects recognition of emotions represented by body motion; and (ii) if so, whether gender effects are independent of emotional content of actions.

Methods

Participants

Thirty four healthy adults, students of the University of Tübingen Medical School, were enrolled in the study. Mean age of females (20) was 23.8±3.7 years, and mean age of males (14) was 22.9±2 years. There was no age difference between female and male participants. The groups were comparable in terms of educational and socio-economic status. All participants had normal or corrected-to-normal vision and heterosexual orientation. None had a history of neurological or psychiatric disorders, and previous experience with such displays or tasks. Participants were run individually. Informed written consent was obtained in accordance with the requirements of the local Ethical Committee.

Experimental design

We used point-light displays portraying knocking arm motion (Pollick et al., 2001). Point-light displays were recorded during performance of knocking with different emotional content (happy, neutral, and angry). We used animations with happy and angry motions, because happiness and anger are quite similar on the activation dimension, and these animations tended to have fast and jerky movements. Recording was performed using a 3D position measurement system at a rate of 60 Hz (Optotrak, Northern Digital Inc., ON, Canada). Each display consisted of six point-light dots placed on the head, shoulder, elbow, wrist, and the first and forth metacarpal joints of an otherwise invisible right hand of female and male actors (Figure 1). The size of all point-light knocking stimuli was standardized in such a way that in the first frame, the distance from the head to the first metacarpal joint was identical for all actors. For each emotion, six different displays with equal number of knocking performed by female and male actors were created. By using the Presentation software (Neurobehavioral Systems Inc., Albany, CA, USA), each video was displayed five times during experimental session that resulted in 30 trials per emotion. The whole experimental session consisted of a set of 90 displays representing three emotions in a random order, and took about 15-20 min per participant. Each display was shown for 1 sec. We used a 3 alternative-forced choice paradigm. On each trial, participants indicated whether a display portrayed happy, neutral or angry knocking. No immediate feedback was given.

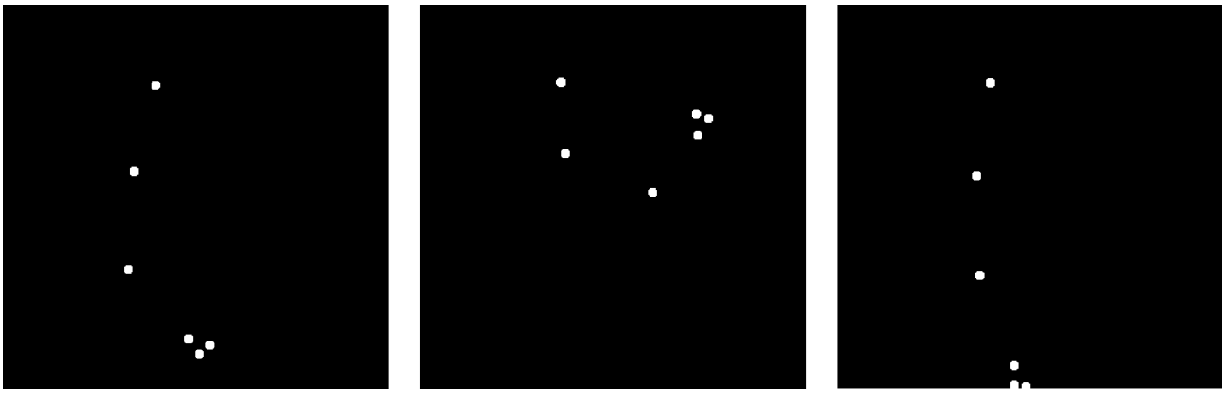

Figure 1. Three static frames taken from the dynamic sequence representing knocking motion by a set of dots placed on the arm joints, shoulder and head of an otherwise invisible actor. Actors were seen facing right, in a sagittal view, and struck the surface directly in front of them.

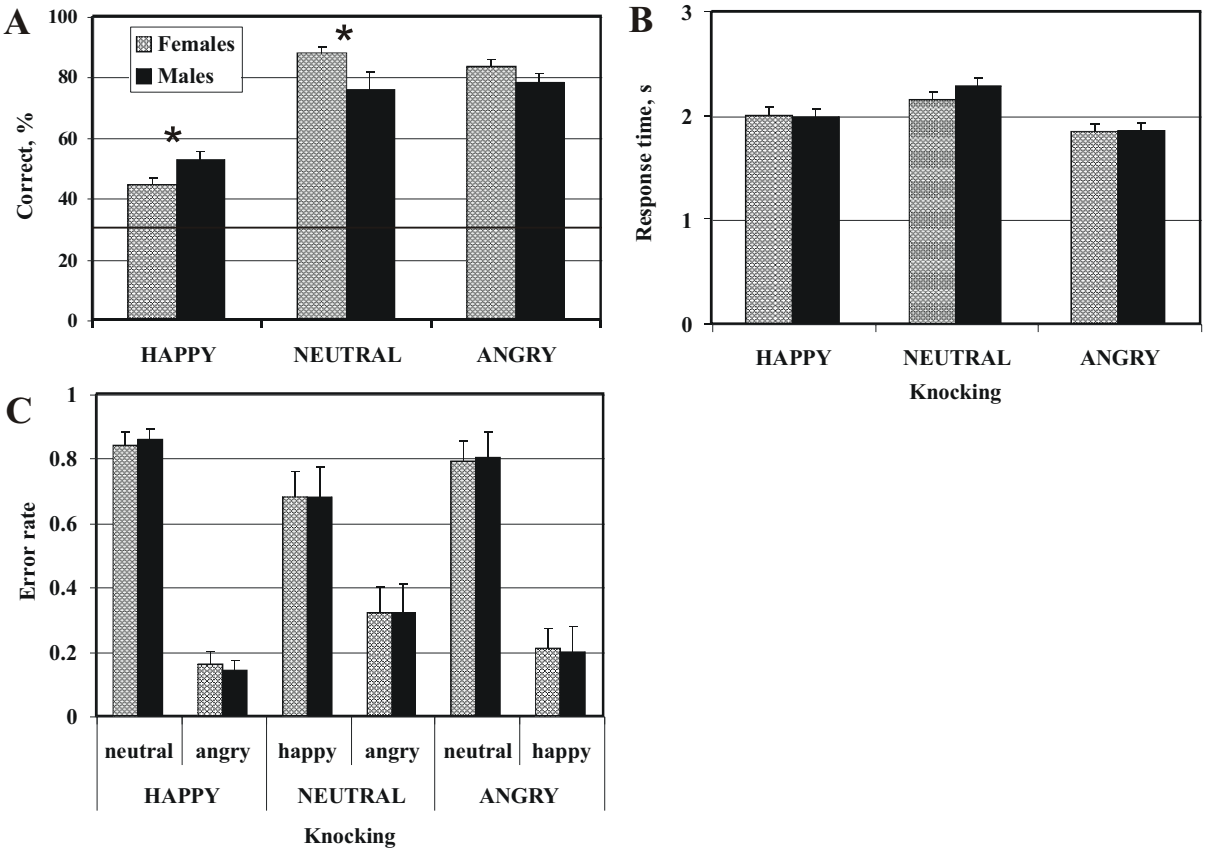

Figure 2. Recognition of happy, neutral and angry point-light knocking by females and males. (**A**) Percentage correct. Males outperformed in recognition of happy knocking ($p < 0.015$), whereas females excelled in recognition of neutral knocking ($p < 0.027$) and tended to over-perform in recognition of angry knocking ($p < 0.07$). Bold horizontal line indicates chance level. Significant differences are indicated by an asterisk; (**B**) Error rates. The lack of sex differences in recognition accuracy of emotional content of knocking were not caused by gender-related bias for mistaking one emotion for another; (**C**) Response time. Females and males do not differ in response time. Vertical bars represent ±SE.

Results

In both females and males, recognition of all emotional expressions was significantly above chance ($p < 0.001$). However, recognition of happy knocking was less accurate than of neutral and angry actions. This is consistent with the outcome of previous studies on emotion recognition through point-light human locomotion and dance (Dittrich et al., 1996; Chouchourelou et al., 2006; Ikeda & Watanabe, 2009).

Individual number of correct responses was submitted to a 2 x 3 repeated-measures ANOVA with factors Gender (female/male) and Emotional expression of knocking (happy/neutral/angry). This analysis did not reveal a main effect of gender ($F_{(1,32)} = 0.21$, ns).

However, a main effect of emotional expression ($F_{(2,32)}$ = 82.94, $p < 0.001$) and interaction between the factors Gender x Emotional Expression ($F_{(2,32)}$ = 6.23, $p < 0.003$) were highly significant. Post hoc pair-wise comparisons indicated that males outperformed in recognition of happy knocking ($t_{32} = 2.58$, $p < 0.015$), whereas females tended to over-perform in recognition of angry knocking ($t_{32} = 1.87$, $p < 0.07$) and clearly excelled in recognition of neutral knocking ($t_{32} = 2.32$, $p < 0.027$). The data, therefore, reveals that gender effects are modulated by emotional contents of actions.

Error analysis (Figure 2B) indicated that by both females and males, happy knocking was mistaken for neutral knocking in more than 80% of wrong responses (sex difference: $t_{32} = 0.97$, $p = 0.34$, ns). In turn, with the lack of gender differences, neutral knocking was misperceived as happy actions in about 70% of error responses (sex differences: $t_{32} = 0.68$, $p = 0.49$, ns). In about 80% of error trials in response to angry knocking, both females and males mistook angry knocking for neutral knocking (sex difference: $t_{32} = 0.78$, $p = 0.44$, ns). The lack of sex differences in error rate demonstrates that gender effects in recognition accuracy of emotional content of knocking are not caused by gender-related bias for mistaking one emotion for another.

For response time analyses (Figure 2C), a 2 x 3 repeated-measures ANOVA was performed on individual values with factors Gender (female/male) and Emotional expression (happy/neutral/angry). This analysis did not reveal any effect of gender ($F_{(1,32)} = 0.05$, ns) as well as any interaction of factors Gender x Emotional Expression on response time ($F_{(2,32)} = 0.9$, ns). However, a main effect of emotional expression was significant ($F_{(2,32)} = 35.16$, $p < 0.001$), with the fastest response to angry knocking, and the slowest response to neutral knocking. This indicates that recognition of neutral knocking was more difficult than of angry and happy knocking. Post hoc pair-wise comparisons showed no gender difference in response time to happy ($t_{32} = 0.74$, $p = 0.46$, ns, average 2.00±0.39 s and 1.99±0.28 s from the stimulus onset, for females and males, respectively), neutral ($t_{32} = 1.61$, $p = 0.12$, ns; average 2.15±0.33 s and 2.28±0.3 s, for females and males, respectively), and angry knocking ($t_{32} = 0.77$, $p = 0.44$, ns; average 1.84±0.32 and 1.85±0.28, for females and males, respectively). Taken together, the findings indicate that gender does not affect speed of body language reading. For both females and males, swiftness of response to body language depends on the emotional content of actions.

Discussion

The outcome of the study indicates that gender affects accuracy rather than speed of body language reading. To the best of our knowledge, the present work delivers the first evidence for sex effects in body language reading. The gender effect, however, is modulated by the emotional content of actions. Females tend to excel in recognition accuracy of angry knocking, whereas males over-perform in recognition of happy actions. Furthermore, females clearly surpass males in recognition of emotionally neutral knocking. The lack of gender differences in error rate indicates that gender effects in recognition accuracy are not caused by gender-related bias.

Based on popular wisdom, one can expect that while women possess soft skills in social perception including high sensitivity to positive emotional signals and subtle details, men might outperform in recognition of negative menacing expressions. This assumption is based on the different evolutionary and socio-cultural roles of both genders (Biele & Grabowska, 2006; Proverbio et al., 2008). The high sensitivity of women to positive emotions has been related to their role as primary offspring care-providers. Social cognition in men is presumably connected with active interactions and immediate reactions, and, therefore, emotion perception is likely associated with motor programs. Anger detection is usually associated with a need to act, for

example, escape from a person or prepare to confront the person. However, the data available are controversial. In the present study, males over-perform in recognition of emotionally positive happy actions. Moreover, males are equally responsive to happiness conveyed through static and dynamic happy faces (males rate the intensity of dynamic and static expressions of happiness equally high), whereas females are less responsive to happiness in static faces (Biele & Grabowska, 2006). Presumably, this indicates that males are better tuned to subtle expressions of happiness in faces and actions. This might hold true, at least, for a population of young men with a high educational level as those participated in the present study. The most prominent outcome of the study is that females had a clear advantage in recognition of neutral knocking. This suggests that women are better tuned to the lack of emotional content in body actions. Future research should clarify whether similar gender effects in body language reading occur with other repertoires of actions.

What is the nature of gender effects in body language reading? One possibility is that gender differences have neurobiological sources (Cahill, 2006), and brain mechanisms underpinning body language reading are sex-specific. The social cognition network, commonly referred to as the *social brain*, primarily involves the parieto-temporal junction, temporal cortices including the fusiform face area and the superior temporal area (STS), orbitofrontal cortices and the amygdala. The right STS is a cornerstone for processing of meaningful body motion (Pavlova et al., 2010a; Wyk et al., 2009). Is the social brain sex-specific? This is an open question.

In accordance with widespread belief, it is reported that the female brain is more responsive to social stimuli represented in still images (Proverbio et al., 2009). Recent ERP findings indicate that in females, processing of actions' goals occurs earlier (Proverbio et al., 2010). Neuroimaging reveals that gender effects are not evident in the neural circuitry underpinning visual processing of social interaction, but rather in the regions engaged in perceptual decision making: in females, the neuromagnetic gamma response peaks earlier over the left prefrontal cortex (Pavlova et al., 2010b).

Gender effects at behavioral level do not necessarily imply that there are sex-related differences in brain activation subserving body language reading. Moreover, sex differences in performance on social cognition tasks can be partly impacted by socio-cultural stereotypes (Pavlova et al., 2010c). Several types of interrelations between behavioral measures and brain mechanisms engaged in social perception should be taken into account: (i) sex differences both in behavioral and brain responses; (ii) sex differences detectable either at behavioral level or only in brain activation; and (iii) absence of sex differences both at behavioral and brain levels (Pavlova, 2009). Noteworthy, gender-related dimorphism in the brain may not only elicit but also prevent behavioral differences if they are maladaptive (de Vries, 2004). Future research should shed light on sex differences in incidence of neuropsychiatric conditions characterized by impairments in social cognition such as autistic spectrum disorders, depression, and schizophrenia.

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