available at www.sciencedirect.com

ScienceDirect

www.elsevier.com/locate/brainres

BRAIN RESEARCH

Research Report

Perception of intentions and actions: Gender stereotype susceptibility

Marina A. Pavlova[a,b,*], Matthias Wecker[a,b], Kerstin Krombholz[a,b], Arseny A. Sokolov[c]

[a]Department of Pediatric Neurology and Child Development, Children's Hospital, Eberhard Karls University of Tübingen, Tübingen, Germany
[b]Institute of Medical Psychology and Behavioral Neurobiology, MEG Centre, Eberhard Karls University of Tübingen, Tübingen, Germany
[c]Department of Neurosurgery, Eberhard Karls University of Tübingen, Tübingen, Germany

ARTICLE INFO

Article history:
Accepted 19 November 2009
Available online 27 November 2009

Keywords:
Perception of intentions and actions
Gender
Stereotype
Visual social cognition
Brain mechanisms

ABSTRACT

Gender differences are evident in the comprehension of social signals, but the underlying basis for these differences is unclear. There is some indication that gender effects have neurobiological sources. Here we manipulated stereotype messages about gender differences in a social cognition task, on which no gender gap has previously been documented. The outcome indicates that manipulation of stereotype messages elicits gender effects. A positive message enhances performance, whereas a negative message diminishes it. Furthermore, this effect is more pronounced in females, with a greater force of a negative stereotype message. The study provides novel insights into the possible sources of gender related fluctuations in social cognition. The findings are discussed in terms of behavioral components and brain mechanisms underpinning gender effects in social cognition.

1. Introduction

Gender differences are well known in performance on a variety of cognitive tasks. In general, males outperform on tasks involving spatial and mathematical reasoning, whereas females excel in language and episodic memory (Andreano and Cahill, 2009; Hamilton, 2008). Recent data indicate that not just visual spatial abilities of navigation and mental rotation are impacted by gender, but also some aspects of social perception are gender dependent. Perception of intentions and actions is of extreme importance for a variety of daily life situations and adaptive social behavior. This ability constitutes a central component of social competence. In accordance with wide spread wisdom, women are reported to be more proficient in recognition of facial emotions (Montagne et al., 2005) and intentional expressions (discrimination between friendliness and sexual interest) in still photographs (Farris et al., 2008). As a rule, however, facial expressions can only signal emotional states and affect, but do not provide information on how to deal with it (De Gelder, 2006). Expressions of the whole body, body language, gestures and actions of others are much richer source of information for social interaction. Gender influence on social perception of actions and intentions is, however, largely unknown.

There is some evidence that gender effects have neurobiological sources (e.g., Bourne, 2005; Cahill, 2006). On the other hand, gender differences in performance can be elicited by experiential factors and stereotypes (Wraga et al., 2006). A positive (though false) stereotype message enhances performance of women on the mental rotation task, on which females are consistently reported to be least successful than males. However, performance of women on mathematical

* *Corresponding author*. Social and Cognitive Developmental Neuroscience Unit, Department of Pediatric Neurology and Child Development, Children's Hospital, Hoppe-Seyler-Str. 1, 72076 Tübingen, Germany. Fax: +49 7071 295253.
E-mail address: marina.pavlova@uni-tuebingen.de (M.A. Pavlova).

0006-8993/$ – see front matter © 2009 Elsevier B.V. All rights reserved.
doi:10.1016/j.brainres.2009.11.046

tests is hindered when they are reminded of gender differences in mathematical abilities (Cadinu et al., 2003, 2005). Furthermore, gender-specific stereotype messages may not only enhance or diminish performance level, but can also substantially modulate activation of the underpinning brain networks (Wraga et al., 2007).

Here we address the issue of whether, and, if so, how manipulation of information about gender differences in social cognition affects performance. The event arrangement (EA) task was administered to female and male participants. For this task, participants have to organize a set of cards depicting an event as a series of snapshots in a comic-strip fashion. It is assumed that good performance on such a task requires understanding the characters' mental states (Baron-Cohen et al., 1986; Pavlova et al., 2008; Völlm et al., 2006). For successful performance, participants need to reflect the core of the story, which is often based on veridical perception of intentions and dispositions of the characters involved in this particular event. Previous work indicated that there is the lack of gender differences in performance on this task (Pavlova, 2009). Here we manipulated gender stereotype messages, informing one group of participants prior to testing that usually females over-perform on the EA task, whereas the other group has been provided with information that males have an edge in performance. We asked whether and, if so, how these gender stereotype messages affect performance.

2. Results

Individual scores on the task were submitted to a 2×3 ANOVA with factors Gender (female/male) and Information (neutral/positive for females/positive for males). This analysis reveals a highly significant interaction between the factors ($F(2,80) = 7.89$, $p<0.001$). As expected from earlier work (Pavlova, 2009), no gender differences in performance of the group without any gender-specific information have been revealed by post hoc pair-wise comparisons ($t(25) = 0.33$, two-tailed, $p = 0.74$, n. s.; average 9.44±2.46 and 10.14±3.3, for females and males, respectively). The information that females are usually better on the task leads to significant differences in performance within the group, enhancing performance of females and diminishing performance of males ($t(24) = 2.27$, one-tailed, $p<0.03$; average 10.7±1.07 and 9.58±1.73, for females and males, respectively). In turn, the information that males are usually better leads to highly significant differences in performance, enhancing performance of males and substantially deteriorating performance of females ($t(28) = 4.82$, one-tailed, $p<0.0001$; average 7.18±2.09 and 10.68±2.19, for females and males, respectively).

Fig. 1 shows mean scores for females and males of each group. Inspection of this figure suggests that gender related information more strongly affects performance of females. To prove this assumption, a 1×3 ANOVA with factor Information (neutral/positive for females/positive for males) was separately conducted for females and males. For females, the effect of information was highly significant ($F(2,39) = 13.1$, $p<0.0001$), whereas for males it was not ($F(2,38) = 0.65$, $p = 0.53$). In other words, females demonstrate substantial fluctuations in performance depending on the gender stereotype message.

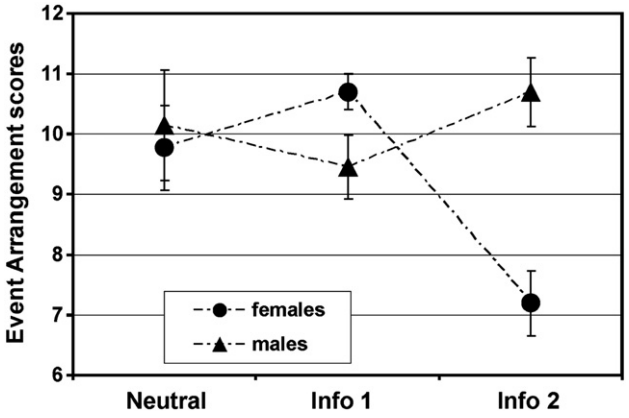

Fig. 1 – Mean scores on the EA task. Female (circles) and male (triangles) participants in the groups with different information prior to testing: (A) neutral information, (B) explicit positive gender stereotype information for females (INFO 1: "Females are usually better on this task") and (C) explicit positive gender stereotype information for males (INFO 2: "Males are usually better on this task"). Vertical bars represent ±SE.

Inspection of Fig. 1 raises the possibility that positive and negative stereotype information has different impact on performance of females and males. Moreover, in females, the impact of positive and negative stereotype messages substantially differs in its magnitude. A 2×2 ANOVA with factors Gender (female/male) and Information (positive/negative) revealed significant main effects of Gender ($F(1;54) = 5.7$, $p<0.02$) as well as Information ($F(1,54) = 21,6$, $p<0.0001$). The interaction of factors was also significant ($F(1,54) = 5.9$, $p<0.02$). Under the influence of an explicit positive stereotype message, there was no difference in performance of females and males ($t(27) = 0.71$, one-tailed, $p = 0.48$, n.s.), whereas an implicit negative information causes a dramatic decrease in performance of women as compared with men ($t(25) = 3.59$, one-tailed, $p<0.001$).

3. Discussion

The outcome of the study indicates that gender stereotype messages affects perception and understanding of intentions and actions. A positive message enhances performance on the event arrangement task, whereas a negative message causes a decrease in performance. Furthermore, the impact of stereotype messages about gender differences on social perception is gender dependent. The effect is more pronounced in females with a greater impact of a negative stereotype message.

To the best of our knowledge, for the first time, we demonstrated gender-specific effects of stereotype message in social cognition. Furthermore, as compared with previous work (e.g., Cadinu et al., 2003, 2005; Wraga et al., 2006, 2007), the effect of stereotype message occurred on the task on which no gender differences have been documented in the absence of any gender stereotype information. Therefore, we demonstrated *pure* effects of both positive and negative gender stereotype information on performance.