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Social status gates social attention in humans

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Humans tend to shift attention in response to the averted gaze of a face they are fixating, a phenomenon known as gaze cuing. In the present paper, we aimed to address whether the social status of the cuing face modulates this phenomenon. Participants were asked to look at the faces of 16 individuals and read fictive curriculum vitae associated with each of them that could describe the person as having a high or low social status. The association between each specific face and either high or low social status was counterbalanced between participants. The same faces were then used as stimuli in a gaze-cuing task. The results showed a greater gaze-cuing effect for high-status faces than for low-status faces, independently of the specific identity of the face. These findings confirm previous evidence regarding the important role of social factors in shaping social attention and show that a modulation of gaze cuing can be observed even when knowledge about social status is acquired through episodic learning.

Keywords: attention; gaze cuing; social cognition

1. INTRODUCTION

Research has shown that individuals belonging to several species, including humans, tend to shift their attention in the direction gazed by conspecifics, a phenomenon reflecting orienting of social attention known as gaze cuing [1–3]. Social attention is an essential ability for obtaining an empathic contact with others and to discover potentially relevant information in the environment [3].

Although gaze cuing is a robust phenomenon that can be considered automatic in several regards [4,5], evidence is accumulating showing that it is sensitive to several social modulators. A pioneer animal study reported that submissive macaque monkeys (*Macaca mulatta*) showed a generalized gaze-cuing effect independently of whether the face stimulus depicted a high- or a low-status individual, whereas dominant macaque monkeys selectively followed the gaze of high-status individuals ([6], cf. [7] for a non-significant effect of social ranking on gaze following). Dominant-like exemplars, who are likely to have elevated testosterone levels, are more closely attended to and trigger stronger gaze-cuing effects. A related modulation has recently been demonstrated also in humans, who show greater gaze-cuing effects for artificially masculinized than for feminized faces [8]. Although physical shapes and hormonal levels can deeply influence individual ranking within the group [9], especially in human communities social hierarchies are to a large extent determined by intellectual capacities and skills, so that power positions are not necessarily occupied by the physically strongest individuals. In this case, there might be no reliable perceptual cues that allow the perceivers to infer the relative social status of other individuals but one has to rely on episodic learning.

In the present research, we addressed the impact of social status information on social attention in humans, independently of the physiognomic traits of the cuing face. To this end, we employed a standard gaze-cuing paradigm [10] and manipulated the status of the cuing faces via a preliminary learning phase. Specifically, we used face stimuli depicting people of different ages (older and younger adult males) and two versions of fictive *curriculum vitae* (CV) conveying opposite social status information. One group of participants was asked to read CVs in which older adults were associated with a high social status and younger adults to a low social status; for the remaining participants, the association between status and age group was reversed. We thus manipulated social status so as to associate each stimulus face to both high and low status. In so doing, there was no correlation between social status and the perceptual features of the faces used as stimuli in the gaze-cuing task. Our expectation was to observe greater gaze-cuing effects for the faces that in each condition were presented as high-status individuals.

2. MATERIAL AND METHODS

Forty-six undergraduates (mean age = 23 years, s.d. = 2.71; 30 females) from the University of Padova participated as volunteers. All had normal or corrected-to-normal vision. The study was conducted in accordance with the Declaration of Helsinki.

Sixteen full-colour photos of adult males bearing a neutral expression were used as stimuli (half depicting younger adults, half depicting older adults; see electronic supplementary material, text S1). In order to induce an association between faces and social status, participants were asked to read fictive CVs associated with each face. Participants were randomly assigned to one of two conditions. In condition 1, the CVs of older adults emphasized that they had a relative high social status (e.g. 'Dean of a Faculty of Architecture. President of the European Eco-Sustainable Constructions Society'), while younger adults had a relative low social status (e.g. 'He would like to attempt the test for being admitted to the Faculty of Pharmacy'). In condition 2, the same faces of condition 1 were used, but in this case different CVs were administered to participants, in which social status information related to older and younger adults was reversed (e.g. younger adults: 'Graduated with honours in physics. He is currently working as researcher in a famous European laboratory'; older adults: 'Retired factory worker. He did not complete primary school'). In this manner, in two conditions, the same faces were associated with opposite social status information. Status was mainly related to educational/academic information that was highly relevant for the participants recruited in the study (i.e. undergraduate students). A perfect correlation between age and status within each condition was created so, as to facilitate the retrieval of the information about the status of the face stimuli during the gaze-cuing task. The CVs were pretested (electronic supplementary material, text S2). Immediately after having read the CVs, participants took part in a gaze-cuing task in which the same 16 faces were used as cuing faces.

Stimulus presentation and data collection were controlled by a PC running E-Prime v. 1.1. Participants sat approximately 57 cm from a 17-inch monitor (1024 × 768 pixel, 60 Hz). Stimuli were presented on a black background. Each trial began with the presentation of a white fixation cross (0.82°) in the centre of the screen for 900 ms (fixation frame), followed by a central face (21.2° height × 14° width) with direct gaze (face frame; figure 1). After 900 ms, the

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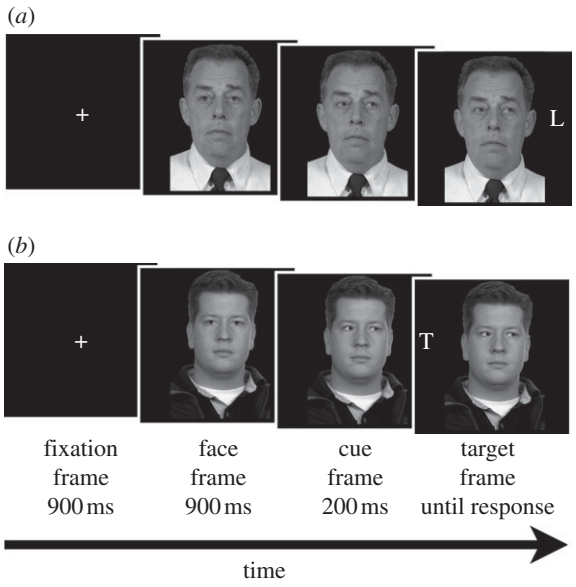

Figure 1. Illustration of stimuli (not drawn to scale) and sequence of events for (*a*) a spatially congruent trial with an older adult and letter 'L' target and (*b*) a spatially incongruent trial with a younger adult and letter 'T' target.

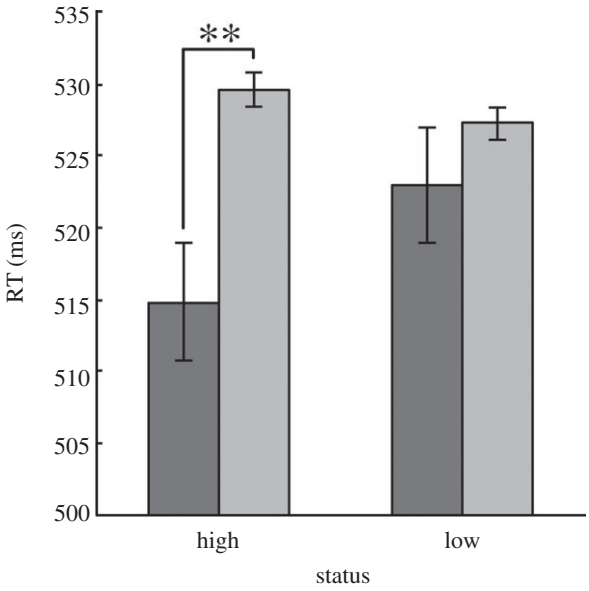

Figure 2. Mean RTs (±s.e.m.) collapsed across conditions for spatially congruent (dark grey) and incongruent (light grey) trials as a function of the social status of the cuing face. Double asterisks denote *t*-test $p < 0.01$.

same face appeared with averted gaze (cue frame). This photograph was obtained by moving the irises 0.25° to the right or to the left from the original central position using The GIMP v. 2.6. After 200 ms, a white target letter (L or T, 0.82°) appeared 11° to the left or right of the centre of the screen in one of two possible locations: spatially congruent or incongruent with gaze direction. The target frame remained visible until a response was provided. Gaze direction was uninformative as regards target location and participants were instructed to maintain fixation at the centre of the screen.

Instructions emphasized both response speed and accuracy. Participants responded using their right and left index fingers. Half of the participants were instructed to press the 'K' key of a standard keyboard if the target was an 'L', and the 'D' key if the target was a 'T'. The remaining participants responded using the opposite mapping. In the case of a wrong response, the text 'ERROR' appeared in white centred on the screen for 500 ms. There were 64 trials for each condition defined by congruency between gaze direction and target location (congruent versus incongruent) and social status (high versus low), for a total of 256 trials presented in a random order.

3. RESULTS

All trials in which participants committed an error (3.62%) were removed. Preliminary analyses of response times (RTs) showed that participant's gender had no effect, and therefore, this factor was not considered. A $2 \times 2 \times 2$ mixed ANOVA was conducted with cue-target spatial congruency (congruent versus incongruent) and social status (high versus low) as within-participants factors, and condition (condition 1 versus condition 2) as between-participant factor. The main effect of cue-target congruency was significant, $F_{1,44} = 13.071$, $p = 0.001$, $\eta_p^2 = 0.229$, owing to faster RTs on congruent (M = 520 ms, s.e. = 9.56) than on incongruent (M = 530 ms, s.e. = 8.62) trials. Critically, the cue-target congruency × social status interaction was also significant, $F_{1,44} = 6.141$, $p = 0.017$, $\eta_p^2 = 0.122$. Paired *t*-tests indicated that participants shifted their attention in response to the averted gaze of high-status faces, $t_{45} = 3.808$, $p < 0.01$, $d = 0.236$, but not in response to the averted gaze of low-status faces, $t_{45} = 1.381$, $p = 0.174$, $d = 0.062$ (figure 2). No other significant effect emerged (all *p*s > 0.163; see electronic supplementary material, tables S1–S3 for further statistical analyses). This overall pattern is inconsistent with the possibility that the physiognomic traits of the specific faces used in the present study played a relevant role in the gaze-cuing effects that we found. A second mixed ANOVA conducted on the percentage of errors with the same factors as earlier revealed a main effect of cue-target spatial congruency, $F_{1,44} = 7.036$, $p = 0.011$, $\eta_p^2 = 0.138$, reflecting more errors on incongruent (M = 3.89%, s.e. = 0.53) than on congruent (M = 2.93%, s.e. = 0.54) trials. No other significant effect emerged (all *p*s > 0.113). Thus, speed–accuracy trade-off cannot account for the present findings.

4. DISCUSSION

The present results demonstrate that information regarding social status acquired through episodic learning is sufficient to moderate gaze cuing in humans. Indeed, our participants consistently shifted attention only in response to the averted gaze of a face that was described as depicting a high-status individual. This suggests that gaze cuing is not immune to top-down influences, so that it can be conceived as a conditionally automatic process, which is modulated by contextually relevant social information [11].

It is well-known that social status deeply shapes social interactions, and that humans are particularly sensitive to social hierarchies. Indeed, people preferentially allocate attentional resources to high-status individuals. In this regard, it has recently been demonstrated that people tend to gaze at high-status individuals more often and for longer than at low-status individuals [12], and that high-status faces are better encoded in memory and processed more holistically [13]. Based on the idea that high-status individuals could be considered as more relevant sources of information when

compared with low-status individuals, it has been hypothesized that gaze cuing could be influenced by perceived social status [6].

The perception of social status can be derived from at least two different sources of information. One is related to the physiognomic traits of the face, and previous research showed that gaze cuing is significantly reduced (if not totally abolished) for apparently less dominant faces [8]. Alternatively, the perception of social status can rely on verbal social information concerning the specific roles one has within the group. This latter source of information is especially relevant among humans, for whom achievements based on intellectual capacities more heavily shape social hierarchies. Our findings show that, even when the impact of physiognomic traits is controlled for by counterbalancing the face–status association, social status influences gaze cuing, so that this phenomenon is magnified when participants view faces of high-status individuals, irrespective of their facial characteristics. On the basis of the verbal information received, people build up exemplar-based representations that are then retrieved when performing the gaze-cuing task. This mechanism appears to be highly adaptive for regulating social life. Indeed, it implies that we rapidly encode the relative social status of the individuals populating our environment and we shape our social attention processes accordingly. The fact that humans selectively attend to the locations gazed by high-status individuals might be interpreted as further evidence of the possible existence of a cognitive process that boosts the identification and monitoring of high-status individuals [12,14]. This mechanism is likely to be particularly relevant for low-status individuals who more heavily depend on high-status individuals [6]. Future studies will need to address this issue, as well as the time-course of the interaction between social processing and gaze cuing, possibly clarifying whether the observed modulation reflects early-rising reflexive mechanisms.

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