Don't Look Me in the Eyes: Automatic Orientation to the Eyes of In- and Outgroup Members

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Abstract

When we look at someone's face, we automatically attend to the eye region. This phenomenon is, however, not entirely controllable. To investigate whether the controllability of this phenomenon differs between in- and outgroup eyes, an eye-tracking study with 52 Caucasian participants viewing Caucasian and Oriental stimulus faces was conducted. Participants were instructed to either look at the stimulus faces freely, or to avoid looking to either eyes or mouth. When looking freely, participants attended equally long to the eyes of both ethnicities. When instructed to avoid eyes or mouth, participants were able to suppress their gaze to both features entirely independent from the ethnicity of the displayed faces. Together, no different gaze patterns towards Oriental and Caucasian faces were found. The results imply that differential behaviour towards Oriental and Caucasian people can not be explained by differences in early stages of visual attention.

Keywords: Visual Attention, Intergroup Face Perception, Social Categorisation, Eye Tracking, Eye Movements

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Introduction

The human face conveys a wide variety of social information and is the most important feature in social cognition. When looking at someone's face, people easily extract valuable information, e.g., on facial expressions or identity (Calder, Rhodes, Johnson, & Haxby, 2011). Therefore, people most frequently attend to the eye region (Henderson, Williams, & Falk, 2005; Janik, Wellens, Goldberg, & Dell'osso, 1978). Even when people are instructed to avoid, eye contact seems not entirely controllable (Laidlaw, Risko, & Kingstone, 2012). Recent research and theories in social psychology indicate that people use different strategies for ingroup versus outgroup face processing (Calder et al., 2011). For instance, a recent eye tracking study by Kawakami et al. (2014) demonstrated that people preferentially attend to the eyes of ingroup over outgroup members. Yet, it is still unclear which processes underlie the tendency to look towards the eye region: Do people use different mechanisms for the bias towards the eyes in ingroup relative to outgroup face processing? The aim of the present study is to explore whether the controllability of the bias towards the eyes differs between ingroup and outgroup face processing. Thus, I contribute to the line of research that seeks to understand how face perception varies among members of different social categories.

For this purpose, this article first provides a general overview of relevant literature regarding the key role of the eyes in social interaction. Subsequently, I review current research investigating differences in attentional strategies between ingroup and outgroup face processing. In the absence of theories in this field of research, I mainly focus on empirical studies on this topic. Then, I move to the question how the tendency to look to the eyes is controlled and present a paradigm to measure the extent of controllability in gaze behaviour. Following this, I introduce the present experiment in which I used eye tracking technology to monitor how long people attend to the eye region in comparison between ingroup and outgroup faces and measured whether the controllability of the bias towards the eyes differs between ingroup and outgroup face processing.

Attentional Processes during Face Perception

An old adage says *out of sight, out of mind*: What we see or more precisely, where we look at determines what gains access to our mind. Or, in other words, eye movements and fixations indicate the allocation of overt visual attention (Findlay & Gilchrist, 2003). In face perception, people's looks mostly cluster around the eye region. People attend approximately 40% of the looking time to the eyes which is far more than to any other facial feature (Henderson et al., 2005; Janik et al., 1978). Further facial cues that are of the perceivers special interest in face processing are mouth and nose, mainly due to their role in extracting emotional expressions and speech. Mouth and nose receive less attention than the eyes, but still more than expected given their size (Henderson et al., 2005). All other facial features like ears, chin or hair are only rarely attended (Henderson et al., 2005). Regarding these fixations strategies involved in face perception, people apply triangular looking patterns: from the eyes to nose and mouth with a strong preference to the eye region. Given the definition of visual attention at the beginning, the tendency to look towards the eyes can be interpreted as attentional preference to the eyes over all other features of the face.

This tendency to preferentially attend to the eye region is, after all, not really surprising: The eyes hold the most valuable information for social interaction of all facial cues (for a review see Emery, 2000). The eyes inform the perceiver on mental and emotional states (Baron-Cohen, Wheelwright, & Jolliffe, 1997) and help to regulate social interactions (Frischen, Bayliss, & Tipper, 2007). Furthermore, gaze direction is a sign of visual attention and people establish eye contact with the most important social cues (Emery, 2000). Hence, the gaze direction of another person may signal valuable information on preferences or intentions and may help to form impressions of another person (Calder et al., 2002; Frischen et al., 2007; Mason, Tatkow, & Macrae, 2005). On the contrary, people who do not preferentially attend to the eye region often show social deficits. For instance, mental disorders like autism or social phobia are associated with avoidance of eye contact (Dalton et al., 2005; Horley, Williams, Gonsalvez, & Gordon, 2003). In sum, the attentional bias towards the eyes is highly functional as it provides a

broad range of essential information for impression formation and social interaction.

Face Perception in an Intergroup Context

In addition to information on mental and emotional states, the human face also holds a broad range of information on social categories. People can distinguish faces of different age, sex or race easily and quickly (Cloutier, Mason, & Macrae, 2005). Moreover, social categories influence and even bias the way faces are perceived, interpreted and memorized (Calder et al., 2011). One of the best known biases in intergroup face perception is the Other-Race-Effect (ORE): People remember faces of their own race better than faces of other races (for a meta-analysis see Meissner & Brigham, 2001). There has been extensive research on the ORE in the past decades and several theories have been developed (for a review see Young, Hugenberg, Bernstein, & Sacco, 2012). This bias is, however, not limited to race. It is robustly observable for a range of social categories like age (Anastasi & Rhodes, 2005), gender (Wright & Sladden, 2003) or university affiliation (Bernstein, Young, & Hugenberg, 2007). Further research findings also point towards reduced emotion recognition in outgroup faces (for a meta-analysis see Elfenbein & Ambady, 2002). For instance, emotions of cross-culture faces are processed slower and less accurate than emotions of same-culture faces (Elfenbein & Ambady, 2003). Taken together, these findings demonstrate the need to consider the influence of social categorisation on face perception mechanisms because there might exist distinct processes for in- and outgroup face processing.

Visual Attention to Ingroup and Outgroup Eyes. However, less is known about *how* faces of different social categories are perceived and more specifically, which attentional processes are involved. Do people apply different attentional patterns in ingroup versus outgroup face processing? Although the invention of modern eye tracking technologies enables to study human eye movements accurately, only few studies have yet focused on visual attention in face processing in an intergroup context. Consequently, theoretical approaches that allow to predict looking behaviour in intergroup face processing are rare. Theories emerging from research on the ORE

suggest that people are motivated to individuate faces of their own ingroup whereas they are motivated to categorise members of their outgroup (Levin, 1996, 2000). In line with this idea, people search for facial cues that distinguish best between the individual and other members of the same social category in ingroup face processing. On the other hand, when detecting an outgroup cue, a different processing strategy with less deep encoding might start (Levin, 1996, 2000; Sporer, 2001).

An initial study by Blais, Jack, Scheepers, Fiset, and Caldara (2008) first used eye tracking technology to investigate whether people from different cultures differ in the way they look at faces. Eye movements of 14 White and 14 Asian participants were recorded while they viewed pictures of Caucasian and East Asian faces for a following recognition test. The results showed that White participants fixated on the eyes whereas Asian participants fixated on the nose most frequently. This indicates that culture may influence how people look at faces and, specifically, which facial features are attended to. On the other hand, this effect was not depending on the race of the viewed face and accordingly independent from social categorisation processes. In contrast, studies by Goldinger, He, and Papesch (2009) and Wu, Laeng, and Magnussen (2012) showed consistently that White participants attended more and longer to the eyes of White relative to Asian faces. In the experiment by Goldinger et al. (2009), 40 Caucasian participants looked at portraits of East Asian and Caucasian faces while their eye movements were monitored. As a result, participants attended more to the eyes of Caucasian over Asian faces. Subsequently, Goldinger et al. (2009) conducted the same experiment with sample of 18 native Asian participants. In line with the previous results, participants attended more to eyes of their Asian ingroup members. By using the same experimental design and identical stimuli for both groups of participants, Goldinger et al. (2009) demonstrated that people tend to prefer orienting to the eyes of their ingroup over outgroup members. In another study, Wu et al. (2012) exposed 57 Caucasian participants to photographs of Caucasian and Asian faces. Here again, participants spent longer time looking to the eyes of faces of their own race compared with faces of the other race. Furthermore, both studies by Goldinger et al. (2009) and

Wu et al. (2012) report more active face scanning, i.e., more and shorter fixations for own-race compared with cross-race faces. In addition, participants showed greater pupil sizes when presented with cross-race relative to own-race faces, implying greater effort for cross-race face encoding.

In sum, studies that compared visual attention to Asian and Caucasian faces brought up inconsistent results so far. There is evidence that both Asian and Caucasian people might prefer the eyes of their ingroup over their outgroup (Goldinger et al., 2009; Wu et al., 2012) while there are also inconsistent results (Blais et al., 2008). However, these studies all focused on the intergroup context of Asian and Caucasian people. Hence, no reliable conclusion can be drawn of this effect being generally caused by the activation of social categories because the reported effects might be due to this specific intergroup context. For instance, the eyes might be the facial cue that differentiates best between Caucasian and Asian faces. It is therefore obligatory to extend this research to other social groups.

Interestingly, a study by Nakabayashi, Lloyd-Jones, Butcher, and Liu (2012) failed to report attentional preferences of 12 White participants to certain facial features when comparing White with Black target faces. Specifically, participants looked equally long and often to the eyes of Black and White faces. Inconsistently to this, a recent study by Kawakami et al. (2014) found that 29 Caucasian participants attended longer to the eyes of White compared with Black target faces. The inconsistency in the results by Nakabayashi et al. (2012), and Kawakami et al. (2014) might be due to methodological issues: Unlike Nakabayashi et al. (2012), Kawakami et al. (2014) presented the stimuli faces pairwise. The reported effect of preferential attention to the eyes of ingroup members was found in cross-race pairs, i.e. when White and Black faces were presented simultaneously. This procedure may have influenced the results by Kawakami et al. (2014) significantly and most other studies on intergroup differences in visual attention used single target faces (Blais et al., 2008; Goldinger et al., 2009; Nakabayashi et al., 2012; Wu et al., 2012). Nevertheless, this procedure provides valuable insight about how people process two faces of different races simultaneously as it occurs regularly in

day-to-day life in multicultural societies.

Despite this, Kawakami et al. (2014) found that participants attended preferentially to the eyes of ingroup members even in a minimal group situation: 59 participants were randomly assigned to either a blue or purple group but were told that these groups represent two types of personalities based on their answers in a previous personality test. Participants then viewed pairs of White faces and were told that the background colour of the photographs indicates the membership to either the blue or purple personality group. Participants preferentially attended to the eyes of their ingroup members once again. These findings demonstrate that the preference for the eyes of ingroup members apparently is due to the activation of social categories and not explainable by physical differences.

In two further experiments, Kawakami et al. (2014) also studied the impact of motivation to individuate a member of a certain social category on eye gaze. In an "Individuate Black" condition, participants were instructed to try to remember the faces of Black people as "individuals with special attention to what makes them unique". In addition, an analogous "Individuate White" condition and a control condition without any further instructions were established. As a result, in the "Individuate Black" condition, participants preferentially attended to the eyes of Black over White faces. Moreover, the enhanced amount of eye contact in fact led to a better memory for Black faces and therefore abolished the ORE in the "Individuate Black" condition. These results highlight the importance of motivation on the gaze to the eyes of other's and suggest that the greater amount of eye contact to ingroup members might be due to motivational aspects. In a further experiment, Kawakami et al. (2014) studied the effect of eye contact on the willingness to interact with the target faces as a function of their social category. Notably, when participants were instructed to individuate Blacks, they also chose them more likely as a potential interaction partner.

Controllability of the Bias towards the Eyes

As previously discussed, the tendency to look in the eyes of other people is highly functional. But it is still unclear which mechanism drives the gaze to the eyes: Is the eye bias automatically driven or volitionally controllable? Bargh (1994) defined four components of automaticity: *Awareness*, *Intention*, *Efficiency* and *Control*. Regarding my research question, the components *Intention* and *Control* are of central importance whereas *Awareness* and *Efficiency* are not discussed further. For Bargh (1994), an action is intentional if someone is in control of the start of the action. An action is considered as controllable if it can be volitionally stopped. Regarding the bias towards the eyes, any inability to initially avoid to *start* orienting to the eye region shows unintentional parts of the bias. Any inability to *stop* looking to the eyes, if once started, indicates uncontrollable parts of the bias towards the eyes. Furthermore, Bargh (1994) concluded that complex mental processes are seldom entirely automatic or entirely controlled but mostly a combination of both. Thus, one might also expect the bias towards the eyes to be not fully volitional or entirely automatic. In fact, recent studies indicate that the bias towards the eyes is not entirely automatically elicited: Itier, Villate, and Ryan (2007) found that orienting to the eyes depends on task demands. Consequently, the bias towards the eyes is at least partly controllable. However, no conclusions can be drawn to the question to what extent this bias is volitionally controllable.

The "Don't Look" Paradigm. A recent study by Laidlaw et al. (2012) introduced a new paradigm to measure the extent of controllability in gaze behaviour: The "Don't Look" paradigm (DL). After a baseline condition, where participants were instructed to look at the presented faces carefully (Free Viewing, FV), two counterbalanced conditions followed in which participants were either told to completely avoid looking to the eyes (DL:Eyes) or, as a control, to the mouth of the faces (DL:Mouth). Any inability to avoid looking to the demanded features provides evidence for automatic components in looking behaviour. In detail, the direct comparison of the amount of mistakes (e.g., looking to the eyes although instructed to

avoid) in both DL conditions provides a relative measure of controllability in the bias towards the eyes. As a result of this study, participants were largely able to control looking to the eyes, but not entirely. On the contrary, participants were able to fully control their looks to the mouth. Taken together, these results indicate that orienting to the eyes is both, volitional and automatic whereas orienting to the mouth is entirely volitional (Laidlaw et al., 2012).

Overview of Experiment

The aim of the present study was to compare the controllability of the bias towards the eyes between ingroup and outgroup face processing. On the basis of the findings by Kawakami et al. (2014) that people preferentially attend to the eyes of ingroup over outgroup faces, I hypothesized that orienting to the eyes is also less volitionally controllable in ingroup compared with outgroup faces. Hence, I expected that the participants would look longer to the eyes of ingroup faces than to outgroup faces when instructed to avoid in the context of a DL:Eyes-Condition. Additionally, I aimed to replicate both findings which are (a) that the bias towards the eyes is not entirely volitionally controllable (Laidlaw et al., 2012) and (b) that the eyes of ingroup members are preferentially attended (Kawakami et al., 2014) .

Therefore, I exposed Caucasian participants to portraits photographs of Caucasian and Oriental target faces and monitored their gaze behaviour. To my knowledge, no study has yet used Caucasian and Oriental stimuli to examine intergroup differences in visual attention. Specifically, I measured how long the participants attended to the eyes and the mouth of the displayed faces in a Free-Viewing, one DL:Eyes and one DL:Mouth-Condition. I intended to use a similar study design to the experiment by Laidlaw et al. (2012) in order to achieve comparable results. Nonetheless, I chose a full within-subject design with a counterbalanced order of both DL-Conditions because there was no evidence that this might affect the results.

Hypotheses. Taken together, three main hypotheses arise:

(I) In line with the findings by Kawakami et al. (2014), I expected that the

participants would attend longer to the eyes of Caucasian relative to Oriental faces in the Free-Viewing-Condition.

(II) According to Laidlaw et al. (2012), I hypothesized that the participants would attend longer to the eyes in the DL:Eyes-Condition than to the mouth in the DL:Mouth-Condition.

(III) In the DL:Eyes-Condition, I proposed that the participants would attend longer to the eyes of Caucasian faces than to the eyes of Oriental faces.

Methods

Participants

$N = 60$ participants (49 women) undergraduate psychology students took part in the study. Mean age was 22.55 ($SD = 4.76$). All participants had normal or corrected-to-normal vision. Due to the research question, only participants with Caucasian ethnicity were included into data analysis, resulting in a sample of 52 participants (41 women). Participants gave written consent and received a course credit for their participation.

Stimuli

I used 120 portrait photographs of middle-aged men, 60 Caucasian and 60 Oriental. Images were taken from the Amsterdam Dynamic Facial Expression Set (van der Schalk, Hawk, Fischer, & Doosje, 2011) and the Radboud Face Database (Langner, O., Dotsch, R., Bijlstra, G., Wigboldus, D. H., Hawk, S. T., & van Knippenberg, 2010) plus Google Image Search and showed full portraits including neck and hair. All faces showed a neutral facial expression. Photographs were randomly divided into 3 sets, each containing 20 Caucasian and 20 Oriental faces. Each set of photographs was presented in a randomized order and was displayed with an average visual angle of 15.44×18.29 degrees.

In preparation of the experiment, all images were processed using Adobe Photoshop. The background colour was set to an equal shade of grey and clothes were

set to black. Furthermore, as I was interested in the eye region of the images, I coloured all non-brown eyes brown because Caucasian faces had several different eye colours whereas Oriental faces had solely brown eyes. Thereby, perceptual saliency of differing eye colours was eliminated as a confounding variable. In addition, all images were standardized in mean luminance. This is a precondition for measurement of pupil dilations, which were recorded for the purpose of separate study.

Procedure

The experiment was conducted in a window-less laboratory at the campus of the University of Hamburg under normal lighting conditions. Upon arrival at the laboratory, participants were seated in an average distance of 59 cm ($SD = 4$ cm) in front of a 17-inch Tobii T120 Eye-Tracker. This system records gaze positions with a sampling rate of 120 Hz by using front cameras that are embedded in the monitor case. Before data recording, a 9-point-calibration procedure was conducted, followed by a screen with detailed task instructions for the first block.

The experiment consisted of 3 different blocks. First, all participants completed a Free-Viewing-Condition (FV). During this block, participants were shown the first set of photographs with the instruction to look at them carefully. After this, participants completed two different Don't-Look-Conditions (DL) in a counterbalanced order. In the DL:Eyes-Condition participants were told to completely avoid looking in the eyes of the faces. In the DL:Mouth-Condition, participants were instructed to completely avoid looking at the mouth of the faces. The DL:Mouth-Condition was established as a control condition. The three sets of photographs, each consisting of 20 Caucasian and 20 Oriental faces, were randomly assigned to the three blocks of the experiment. Each stimulus face was thus presented only once for every participant. Each image was presented for 5 seconds at the center of the screen. This presentation time is equal to the presentation time used in the study by Laidlaw et al. (2012). In addition, Goldinger et al. (2009) reported that longer presentations times up to 10 seconds did not significantly influence the fixations to certain facial cues. Before each trial, an initial

fixation-cross appeared pseudo-randomly in one of the screen's corners for 2 seconds. This allowed us to examine whether the participants were still attentive and the eye tracker was still accurately calibrated. Previous research on visual attention used these fixation crosses in a similar manner (Laidlaw et al., 2012; Kawakami et al., 2014; Blais et al., 2008; Goldinger et al., 2009; Nakabayashi et al., 2012).

After recording the eye tracking data, participants were instructed to perform an Affect Misattribution Procedure (Payne, Cheng, Govorun, & Stewart, 2005) as a measure of implicit attitudes towards Caucasian and Oriental people. Following this, participants were asked to complete a categorisation task, a stereotypicality rating and a questionnaire assessing intergroup-contact and demographic data. These data are not part of the present study and are therefore not discussed further. Before leaving the laboratory, participants were debriefed and gave their written consent.

Results

Data Handling

In preparation of data analyses, rectangular areas of interests (AOIs) for eyes and mouth were defined individually for every picture. AOIs fully covered eyes and mouth including surrounding areas like eye brows, eye lids and lips. Figure A1 shows example images of a Caucasian and an Oriental face with individually defined AOIs. This handling of AOIs is in line with most previous studies on intergroup face perception (Goldinger et al., 2009; Henderson et al., 2005; Kawakami et al., 2014), except for Laidlaw et al. (2012). To examine whether the AOIs differed in size among ethnicity (Oriental vs. Caucasian) or AOI type (Eyes vs. Mouth), separate two-sample t-tests were calculated. The results showed that the AOIs of the eye region were significantly greater than AOIs of the mouth region, $t(119) = 79.94, p < .001, d = 8.97$, and Oriental faces had greater AOIs than Caucasian faces, $t(118) = -3.19, p = .001, d = 0.58$.

Dependent variable was overall fixation dwell time (total time spent on the AOI across all fixations), which was recorded in milliseconds. Direct comparison between absolute dwell times towards eyes and mouth or between Caucasian and Oriental faces

is not appropriate, because AOI sizes differed among AOI type (Eyes vs. Mouth) and ethnicity (Caucasian vs. Oriental). For instance, if the perceivers gaze scattered randomly over the image, the AOI of the eyes would receive more looks by chance than the AOI of the mouth due to its greater size. Longer dwell times to the eye region could therefore not be interpreted as attentional preference over the mouth region. To take this into account, I report normalized dwell times according to the normalization procedure used by Laidlaw et al. (2012): I calculated the percentage of dwell time by dividing the absolute dwell time to a certain AOI by the overall time to the whole picture. Percentage of dwell time was then divided by the proportional size of the AOI (relative to the size of the whole picture). Subsequently, these values are labelled *normalized dwell times*. A normalized dwell time value of 0 indicates that the AOI received no looks at all. A normalized value of 1 indicates that the AOI was fixated as long as expected given its size ("chance level"). Normalized dwell time values greater than 1 show that the AOI was longer fixated than expected given its size. As an example, an AOI covering 5% of the picture that was fixated for 5% of the overall looking time results in a normalized dwell time value of 1. The same AOI being fixated for 10% of the overall looking time would lead to a normalized value of 2. In line with Laidlaw et al. (2012), normalized values significantly greater than 1 are interpreted as a bias towards that region whereas normalized values significantly smaller than 1 indicate that the particular region was avoided.

To ensure high data quality, I applied two exclusion criteria. First, participants with more than 10% missing data recordings, mostly due to an insufficient calibration of the eye tracker camera, were excluded for data analyses. Second, I took the results of the fixation check into consideration. As noted earlier, a fixation cross appeared randomly in one of the screens corners after each trial for two seconds. Participants who attended less than 40% of the possible looking time over all fixation crosses were also excluded for further analyses. Together, four participants did not fulfill these two criteria, resulting in a final sample of 48 participants.

Free-Viewing Block

Recall that the first hypothesis stated that the participants were expected to look longer to the eyes of Caucasian compared with Oriental faces. Mean dwell times to eyes and mouth region were calculated separately for Caucasian and Oriental faces. Table 1 provides an overview over normalized and non-normalized dwell time values to eyes and mouth across all experimental conditions by ethnicity. A two-way analysis of variances (ANOVA) on normalized dwell time including the within factors AOI type (Eyes vs. Mouth) and ethnicity (Oriental vs. Caucasian) for the FV block was performed.

The results revealed that participants' gaze behaviour did not differ between Caucasian ($M = 5.02, SD = 3.06$) and Oriental faces ($M = 5.17, SD = 2.71$), $F(1, 188) = 0.15, p = .70, \eta_p^2 < .001$. However, the main effect for AOI type reached significance indicating that the eye region ($M = 6.12, SD = 2.08$) was longer fixated than the mouth region ($M = 4.07, SD = 3.20$), $F(1, 188) = 27.32, p < .001, \eta_p^2 = .13$. The interaction of both factors was not significant, $F(1, 188) = 0.24, p = .62, \eta_p^2 = .001$. Normalized dwell times to eyes and mouth across both ethnicities are plotted in figure 1 for the FV condition. To examine whether a general bias towards the eyes and mouth was present, normalized dwell time values were compared against chance level. As mentioned earlier, if the participants' looks would cluster randomly over the picture, normalized values would be 1 for all AOIs. Therefore, single-sample t-tests were performed and revealed a significant bias to attend to both regions, the eyes, $t(95) = 24.10, p < .001, d = 2.45$, and mouth, $t(95) = 9.40, p < .001, d = 0.96$.

Taken together, participants showed a significant bias to attend to both features, eyes and mouth, in the FV condition. This bias was significantly stronger for the eye region than for the mouth. However, contradicting the first hypothesis, this bias was independent from the ethnicity of the displayed faces.

Don't-Look Block

Referring to the second hypothesis, I asked whether the eyes were shorter fixated in the DL:Eyes condition than the mouth in the DL:Mouth condition. As the third

Figure 1. Normalized dwell time to eyes or mouth during the free viewing condition for Oriental and Caucasian faces. Chance level is the value of 1. Error bars display standard errors of the mean. AOI= area of interest.

hypothesis I predicted, that the eyes of Caucasian faces were longer fixated than the eyes of Oriental faces in the DL:Eyes condition. To test these postulations, a two-way ANOVA with ethnicity (Oriental vs. Caucasian) and condition (DL:Eyes vs. DL:Mouth) as within-factors was calculated on normalized dwell times.

The main effect for condition failed to reach significance level, $F(1, 188) = 1.38, p = .24, \eta_p^2 = .007$, indicating that the eyes in the DL:Eyes condition ($M = 0.62, SD = 0.64$) were equally long fixated as the mouth in the DL:Mouth condition ($M = 0.51, SD = 0.60$). The main effect for ethnicity was not significant, $F(1, 188) = 0.52, p = .47, \eta_p^2 = .003$, showing no differences between Caucasian ($M = 0.60, SD = 0.64$) and Oriental ($M = 0.53, SD = 0.60$) faces. Also, no significant interaction effect, $F(1, 188) = 0.056, p = .81, \eta_p^2 < .001$, was found. Figure 2 displays

Table 1

Mean Dwell Times to Areas of Interest across Experimental Condition and Ethnicity

Condition	Non-Normalized Values [ms]			
	Eyes AOI		Mouth AOI	
	Caucasian	Oriental	Caucasian	Oriental
Free Viewing	1938.15	2074.17	530.02	572.45
Don't Look: Eyes	215.15	191.46	1625.84	1801.14
Don't Look: Mouth	2439.05	2600.25	69.15	71.41
Condition	Normalized Values			
	Eyes AOI		Mouth AOI	
	Caucasian	Oriental	Caucasian	Oriental
Free Viewing	5.94	6.29	4.09	4.05
Don't Look: Eyes	0.66	0.58	12.53	12.31
Don't Look: Mouth	7.22	7.47	0.53	0.49

AOI= Area of Interest.

normalized dwell time values to the "to-be-avoided" features during both DL conditions.

As depicted in table 1, all mean normalized dwell times were smaller than 1 for both DL conditions and both ethnicities. To test whether dwell times to eyes and mouth in the DL conditions were significantly below chance level, separate one-sample t-tests against 1 were performed. In the DL:Mouth condition, both the overall dwell time among both ethnicities, $t(95) = -7.91, p < .001, d = .81$, and separate tests for Oriental, $t(47) = -6.21, p < .001, d = .90$, or Caucasian faces, $t(47) = -5.02, p < .001, d = 0.72$, revealed values significantly smaller than chance level. Similar results were found for the DL:Eyes condition: Both ethnicities together, $t(95) = -5.84, p < .001, d = .60$, and separately tested for Oriental, $t(47) = -4.61, p < .001, d = .67$, or Caucasian faces, $t(47) = -3.63, p < .001, d = .52$, showed normalized dwell times smaller than 1. Thus, over both DL conditions and both

ethnicities, all normalized dwell times were significantly smaller than chance level of 1 indicating that participants were able to suppress their looks to the eyes and mouth.

In sum, I did not find support for the second and third hypothesis. The controllability of the gaze did not differ between eyes and mouth. Participants were able to suppress their looks to eyes and mouth entirely. In addition, the ethnicity of the displayed faces did not influence the controllability towards eyes and mouth significantly.

Figure 2. Normalized dwell time to the "to-be-avoided" feature (eyes or mouth) in the don't look conditions for Oriental and Caucasian faces. Chance level is the value of 1. Error bars display standard errors of the mean. AOI= area of interest.

Explorative Analyses

As noted earlier, although my study aimed to replicate the findings by Laidlaw et al. (2012), I chose a different study design: The present study was conducted as a full-within-design: All participants completed the FV condition first, followed by both

DL conditions in a counterbalanced order. On the contrary, Laidlaw et al. (2012) used a between-subject design, with every participant completing either the DL:Eyes or the DL:Mouth condition. To test whether this variation influenced the results in the DL conditions, the order of DL conditions was added to the analyses. A three-way ANOVA with condition (DL:Eyes vs. DL:Mouth), ethnicity (Oriental vs. Caucasian) and order of DL conditions (DL:Eyes first vs. DL:Mouth first) on normalized dwell times revealed a significant main effect for the order of DL conditions, $F(1, 184) = 5.44, p = .02, \eta_p^2 = .03$. Participants who completed the DL:Eyes condition first showed higher normalized dwell times ($M = 0.67, SD = 0.66$) than participants who completed the DL:Mouth condition first ($M = 0.47, SD = 0.57$), $t(180.02) = 2.33, p = .011, d = .34$. However, this effect did not differ between Caucasian and Oriental stimuli or the DL condition indicating that participants who completed the DL:Mouth first were generally better in avoiding eyes and mouth during the DL conditions.

Another characteristic of my study is that three investigators were involved into data collection of whom two were of Caucasian ethnicity and one Oriental. As I studied visual attention in the intergroup context of Oriental and Caucasian ethnicities, one might expect that the presence of investigators of different ethnicities might affect the results. To take this into consideration, I tested the effect of the investigators ethnicity by performing a two-way ANOVA with ethnicity of the stimulus (Caucasian vs. Oriental) and ethnicity of the investigator (Caucasian vs. Oriental) on normalized dwell times. For the FV condition, the investigators ethnicity had no main effect, $F(1, 92) = 2.44, p = .12, \eta_p^2 = .03$. No interaction effect with the ethnicity of the stimulus was found, $F(1, 92) = 0.076, p = .78, \eta_p^2 < .001$. For the DL conditions, the investigators ethnicity had a significant main effect on normalized dwell times, $F(1, 188) = 7.46, p = .007, \eta_p^2 = .04$, indicating that participants attended longer to the "to-be-avoided" features when the Caucasian investigators were present ($M = 0.68, SD = 0.68$) compared with the Oriental investigator ($M = 0.44, SD = 0.53$), $t(185.85) = 2.76, p = .003, d = .40$.

To examine whether gender of the participants affected their gaze behaviour, a

two-way ANOVA with ethnicity (Oriental vs. Caucasian) and gender (male vs. female) on normalized dwell times to the eyes was performed. Note that the sample of the current study consisted of 41 women and only 11 men. Thus, the smaller number of male participants limits the generalizability of this analysis. However, the main effect for gender was significant during FV, $F(1, 92) = 7.80, p = .01, \eta_p^2 = .08$, indicating that men attended shorter to the eyes ($M = 5.06, SD = 2.24$) than women ($M = 6.43, SD = 1.94$), $t(31) = -2.60, p = .007, d = .68$. To extend this analysis to the DL block, a further two-way mixed-factors ANOVA with condition (DL:Eyes vs. DL:Mouth) and gender (male vs. female) was performed. In contrast to the FV condition, no significant main effect for gender, $F(1, 188) = 0.13, p = .71, \eta_p^2 < .001$, and no interaction effect, $F(1, 188) = 0.20, p = .65, \eta_p^2 = .01$, were found for the DL conditions.

Discussion

The primary aim of the experiment was to investigate whether the gaze towards the eyes differs between in- and outgroup face processing. This question is a new perspective on the question how faces of different social categories are perceived. The results indicate that the ability to avoid the bias towards the eyes does not differ among members of different ethnicities. In fact, the gaze towards eyes and mouth was entirely controllable in the DL conditions independently from the ethnicity of the displayed faces. In the FV condition, participants showed a significant bias to attend to eyes and mouth, which was stronger for the eye region. However, the eyes of in- and outgroup members were equally long attended. Taken together, no support was found for the main hypotheses. Participants did not differ in the way they looked at images of Caucasian and Oriental people. Thus, the present results are in conflict to most other studies on visual attention in an intergroup context which mostly reported systematically different gaze behaviour towards faces of different ethnic groups (Goldinger et al., 2009; Kawakami et al., 2014; Wu et al., 2012). To my knowledge, no study has so far focused on differences in visual attention between Caucasian and

Oriental faces. Hence, my experiment extends previous research that seeks to understand the underlying mechanisms of intergroup face perception. As another strength of the experiment, I analysed data of a rather large sample of 52 participants. Samples of previous studies on this topic ranged from 12 participants per cell (Nakabayashi et al., 2012) to 43 participants per cell (Wu et al., 2012).

Most previous studies reported attentional preference for the eyes of ingroup members (Goldinger et al., 2009; Kawakami et al., 2014; Wu et al., 2012), although there were also contradictory results (Blais et al., 2008; Nakabayashi et al., 2012). In my study, no preference for the eyes of neither groups was present. Specifically, the eyes of in- and outgroup faces were equally long attended. In interpreting this result, it is necessary to consider the procedure of the present study. In contrast to other studies on intergroup differences in visual attention (Blais et al., 2008; Goldinger et al., 2009; Kawakami et al., 2014; Nakabayashi et al., 2012; Wu et al., 2012), the present study used Oriental and Caucasian stimulus faces in a Caucasian sample. To my knowledge, no study has yet shown differences in visual attention between these two groups. Attentional preference to the eyes of ingroup faces has so far been demonstrated for Asian-Caucasian (Goldinger et al., 2009; Wu et al., 2012) and Black-White (Kawakami et al., 2014) intergroup contexts. Hence, one possible explanation for the divergence between the present findings and previous results might be that differences between Caucasian-Oriental stimulus faces might not be as salient as differences between Asian-Caucasian or Black-White stimulus faces. Additionally, participants might have gained some expertise in encoding Oriental faces because in today's society in Germany live a great number of Oriental people. Thus, Oriental faces might not be clearly categorised as belonging to the outgroup. A further explanation for the diverging results may be that Kawakami et al. (2014) showed intergroup faces pairwise whereas most other studies including the present experiment presented the images individually. This methodological variation might have highlighted the activation of social categories in the study by Kawakami et al. (2014) and therefore accelerated the effect of preferential attention to the eyes of ingroup members. Furthermore, the stimulus set of the present

study consisted of only male persons while the sample of the study was mostly female. In terms of gender, the displayed faces might have been classified as outgroup which might have biased the categorisation procedure in terms of ethnicity. Nonetheless, most other studies on this topic (Blais et al., 2008; Goldinger et al., 2009; Kawakami et al., 2014; Nakabayashi et al., 2012; Wu et al., 2012) also used only male stimulus images.

Further, the recent finding by Laidlaw et al. (2012) that the bias towards the eyes is less controllable than the bias towards the mouth could not be replicated in my study. The bias towards both features was entirely controllable. One might assume that this might be the case because the present study was conducted as full within-subject design whereas Laidlaw et al. (2012) used a between-subject design. In fact, explorative analyses suggest that this variation had a significant impact on gaze behaviour: Participants who completed the DL:Mouth condition first were significantly better at avoiding eyes and mouth than participants who completed DL:Eyes first. One possible explanation for this might be that the DL:Eyes condition was experienced as highly exhausting, as some participants reported after the experiment. Hence, the worse performance of participants who completed the DL:Eyes first might be due to exhaustion effects. Moreover, the study by Laidlaw et al. (2012) differs in another regard from most other studies on intergroup differences in visual attention: Laidlaw et al. (2012) used hand-drawn AOIs including only eyes and mouth itself without any surrounding areas. This is especially relevant in regard to the used normalization procedure, because AOI size contributes inversely proportional to normalized values. Hence, the greater the AOIs are, the smaller normalized values become when gaze behaviour is constant. For instance, absolute mean dwell time to the eyes in FV was 938.78 ms in the study by Laidlaw et al. (2012) and 1938.15 ms in the present experiment. Although the eyes were more than twice as long fixated in the present study, this only led to a normalized dwell time value of 5.94 in the present experiment whereas the normalized value of 51.66 in the study by Laidlaw et al. (2012) was almost nine times higher. Conclusively, the AOI handling by Laidlaw et al. (2012) leads to higher normalized values in comparison to the present AOI handling. This is relevant

because higher normalized values increase the possibility to discover significant differences between dwell times towards eyes and mouth. To address this assumption, it might be useful to analyse the current data again with AOIs equivalent to Laidlaw et al. (2012).

Regarding the third hypothesis which predicted differences in the controllability of gaze behaviour towards in- and outgroup eyes, several possible explanations emerge. First, this effect has to be considered to be not entirely independent from the first hypothesis: Contradicting the first hypothesis, participants showed no different gaze behaviour towards Oriental and Caucasian faces. Hence, it is reasonable that there were no differences among ethnicity in the attempt to avoid this gaze behaviour. For future research, it might be helpful to test this hypothesis again in an intergroup context for which differences in visual attention strategies have already been robustly shown, e.g., with Asian and Caucasian faces. It might be reasonable, that participants who once showed a bias to prefer the eyes of ingroup members, also suppress their looks to outgroup eyes more easily than their looks to ingroup eyes. Further, regarding the DL block of the experiment, one might assume that the ability to control the gaze towards eyes and mouth varies as a function of time. Recall that Bargh (1994) defined control as the ability to stop an action and it is generally assumed that automatic processes work slower than volitional processes. Indeed, Laidlaw et al. (2012) observed that participants showed more errors in the early compared with late viewing periods of the trials during DL conditions. For future research, these analyses should be applied to the present data to test whether participants differed in the controllability of the bias towards the eyes between in- and outgroup faces in early stages of the viewing period.

Further, as a recent study by Bean et al. (2012) demonstrated, concerns to appear prejudiced can influence gaze behaviour towards outgroup faces. In fact, people with high motivation to appear non-prejudiced first looked longer to outgroup faces than people with low motivation, but with proceeding time, these people increasingly avoided looking to outgroup faces. One might assume that participants in my study were also motivated to appear non-prejudiced towards Oriental people, especially because an

Oriental investigator was involved into data collection. Thus, participants might have applied similar looking patterns to Oriental faces as reported in the study by Bean et al. (2012). Again, this idea calls for analyses comparing early versus late viewing periods.

As noted earlier, attending to the eyes is predictive for several behavioural outcomes, e.g., improved memory for faces (Kawakami et al., 2014), generally increased approach orientation (Mason et al., 2005), or, more specifically, enhanced willingness to interact with the other person (Kawakami et al., 2014). Although future research is needed to investigate how exactly visual attention to the eyes predicts differential behaviour towards members of different social categories, e.g., stereotypes or discriminative behaviour, the present findings suggest that the participants in my experiment do not prefer to interact with members of one of the two ethnic groups. To test this empirically, it might be useful to add a measure of implicit attitudes towards Oriental and Caucasian people for future research, e.g., the Affect Misattribution Procedure (Payne et al., 2005).

As a major conclusion of the experiment can be drawn that gaze behaviour does not necessarily differ among faces of different ethnicities. This finding is, however, incompatible to recent theories that postulate different processing strategies for in- and outgroup faces (Levin, 1996, 2000; Sporer, 2001). Although this may be limited to the specific group of participants, intergroup context or tasks in my experiment, it implies that on early stages of social interaction, people do not necessarily distinguish between people of different social groups. More broadly, if this finding may be replicated in other contexts, one might conclude that differential behaviour towards in- and outgroup members is not manifested on perceptual processes, but rather occurs on later stages of social interaction. This is, after all, good news as it suggests that prejudices and discriminative behaviour can be faced with interventions that address attitude formation processes towards members of different ethnic groups, rather than the modification of highly automatized gaze behaviour.

References

- Anastasi, J. S., & Rhodes, M. G. (2005). An own-age bias in face recognition for children and older adults. *Psychonomic Bulletin & Review*, *12*, 1043–1047. doi: 10.3758/BF03206441
- Bargh, J. A. (1994). The four horsemen of automaticity: Awareness, intention, efficiency, and control in social cognition. In R. Wyer & T. Srull (Eds.), *Handbook of social cognition* (pp. 1–40). Hillsdale, NJ: Erlbaum.
- Baron-Cohen, S., Wheelwright, S., & Jolliffe, T. (1997). Is there a "language of the eyes"? Evidence from normal adults, and adults with autism or asperger syndrome. *Visual Cognition*, *4*, 311–331. doi: 10.1080/713756761
- Bean, M. G., Slaten, D. G., Horton, W. S., Murphy, M. C., Todd, A. R., & Richeson, J. A. (2012). Prejudice concerns and race-based attentional bias: New evidence from eyetracking. *Social Psychological and Personality Science*, *3*, 722–729. doi: 10.1177/1948550612436983
- Bernstein, M. J., Young, S. G., & Hugenberg, K. (2007). The cross-category effect: Mere social categorization is sufficient to elicit an own-group bias in face recognition. *Psychological Science*, *18*, 706–712. doi: 10.1111/j.1467-9280.2007.01964.x
- Blais, C., Jack, R. E., Scheepers, C., Fiset, D., & Caldara, R. (2008). Culture shapes how we look at faces. *PLoS ONE*, *3*. doi: 10.1371/journal.pone.0003022
- Calder, A., Lawrence, A. D., Keane, J., Scott, S. K., Owen, A. M., Christoffels, I., & Young, A. W. (2002). Reading the mind from eye gaze. *Neuropsychologia*, *40*, 1129–1138. doi: 10.1016/S0028-3932(02)00008-8
- Calder, A., Rhodes, G., Johnson, M., & Haxby, J. (2011). *Oxford handbook of face perception*. Oxford University Press.
- Cloutier, J., Mason, M. F., & Macrae, C. N. (2005). The perceptual determinants of person construal: Reopening the social-cognitive toolbox. *Journal of Personality and Social Psychology*, *88*, 885–894. doi: 10.1037/0022-3514.88.6.885
- Dalton, K. M., Nacewicz, B. M., Johnstone, T., Schaefer, H. S., Gernsbacher, M. A.,

- Goldsmith, H. H., ... Davidson, R. J. (2005). Gaze fixation and the neural circuitry of face processing in autism. *Nature Neuroscience*, 8, 519–526. doi: 10.1038/nm1421
- Elfenbein, H. A., & Ambady, N. (2002). On the universality and cultural specificity of emotion recognition: A meta-analysis. *Psychological Bulletin*, 128, 203–235. doi: 10.1037/0033-2909.128.2.203
- Elfenbein, H. A., & Ambady, N. (2003). When familiarity breeds accuracy: Cultural exposure and facial emotion recognition. *Journal of Personality and Social Psychology*, 85, 276–290. doi: 10.1037/0022-3514.85.2.276
- Emery, N. (2000). The eye have it: The neuroethology, function and evolution of social gaze. *Neuroscience and Biobehavioral Reviews*, 24, 581–604. doi: 10.1016/S0149-7634(00)00025-7
- Findlay, I. D., & Gilchrist, J. M. (2003). *Active vision: The psychology of looking and seeing*. Oxford University Press.
- Frischen, A., Bayliss, A. P., & Tipper, S. P. (2007). Gaze cueing of attention: visual attention, social cognition, and individual differences. *Psychological Bulletin*, 133, 694–724. doi: 10.1037/0033-2909.133.4.694
- Goldinger, S. D., He, Y., & Papesch, M. H. (2009). Deficits in cross-race face learning: Insights from eye movements and pupillometry. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 35, 1105–22. doi: 10.1037/a0016548
- Henderson, J. M., Williams, C. C., & Falk, R. J. (2005). Eye movements are functional during face learning. *Memory & Cognition*, 33, 98–106. doi: 10.3758/BF03195300
- Horley, K., Williams, L. M., Gonsalvez, C., & Gordon, E. (2003). Social phobics do not see eye to eye: A visual scanpath study of emotional expression processing. *Journal of Anxiety Disorders*, 17, 33–44. doi: 10.1016/S0887-6185(02)00180-9
- Itier, R. J., Villate, C., & Ryan, J. D. (2007). Eyes always attract attention but gaze orienting is task-dependent: Evidence from eye movement monitoring.

- Neuropsychologia*, 45, 1019–1028. doi: 10.1016/j.neuropsychologia.2006.09.004
- Janik, S. W., Wellens, A. R., Goldberg, M. L., & Dell’osso, L. F. (1978). Eyes as the center of focus in the visual examination of human faces. *Perceptual and Motor Skills*, 47, 857–858. doi: 10.2466/pms.1978.47.3.857
- Kawakami, K., Williams, A., Sidhu, D., Choma, B. L., Rodriguez-Bailón, R., Cañadas, E., ... Hugenberg, K. (2014). An eye for the I: Preferential attention to the eyes of ingroup members. *Journal of Personality and Social Psychology*, 107, 1–20. doi: 10.1037/a0036838
- Laidlaw, K. E. W., Risko, E. F., & Kingstone, A. (2012). A new look at social attention: Orienting to the eyes is not (entirely) under volitional control. *Journal of Experimental Psychology: Human Perception and Performance*, 38, 1132–1143. doi: 10.1037/a0027075
- Langner, O., Dotsch, R., Bijlstra, G., Wigboldus, D. H., Hawk, S. T., & van Knippenberg, A. (2010). Presentation and validation of the Radboud Faces Database. *Cognition and Emotion*, 24, 1377–1388. doi: 10.1080/02699930903485076
- Levin, D. T. (1996). Classifying faces by race: The structure of face categories. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 22, 1364–1382. doi: 10.1037/0278-7393.22.6.1364
- Levin, D. T. (2000). Race as a visual feature: Using visual search and perceptual discrimination tasks to understand face categories and the cross-race recognition deficit. *Journal of Experimental Psychology: General*, 129, 559–574. doi: 10.1037/0096-3445.129.4.559
- Mason, M. F., Tatkow, E. P., & Macrae, C. N. (2005). The look of love: Gaze shifts and person perception. *Psychological Science*, 16, 236–239. doi: 10.1111/j.0956-7976.2005.00809.x
- Meissner, C. a., & Brigham, J. C. (2001). Thirty years of investigating the own-race bias in memory for faces: A meta-analytic review. *Psychology, Public Policy, and Law*, 7, 3–35. doi: 10.1037/1076-8971.7.1.3

- Nakabayashi, K., Lloyd-Jones, T. J., Butcher, N., & Liu, C. H. (2012). Independent influences of verbalization and race on the configural and featural processing of faces: A behavioral and eye movement study. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *38*, 61–77. doi: 10.1037/a0024853
- Payne, B. K., Cheng, C. M., Govorun, O., & Stewart, B. D. (2005). An inkblot for attitudes: Affect misattribution as implicit measurement. *Journal of Personality and Social Psychology*, *89*, 277–293. doi: 10.1037/0022-3514.89.3.277
- Sporer, S. L. (2001). Recognizing faces of other ethnic groups: An integration of theories. *Psychology, Public Policy, and Law*, *7*, 36–97. doi: 10.1037/1076-8971.7.1.36
- van der Schalk, J., Hawk, S. T., Fischer, A. H., & Doosje, B. (2011). Moving faces, looking places: Validation of the Amsterdam Dynamic Facial Expression Set (ADFES). *Emotion*, *11*, 907–920. doi: 10.1037/a0023853
- Wright, D. B., & Sladden, B. (2003). An own gender bias and the importance of hair in face recognition. *Acta Psychologica*, *114*, 101–114. doi: 10.1016/S0001-6918(03)00052-0
- Wu, E. X. W., Laeng, B., & Magnussen, S. (2012). Through the eyes of the own-race bias: Eye-tracking and pupillometry during face recognition. *Social Neuroscience*, *7*, 202–16. doi: 10.1080/17470919.2011.596946
- Young, S. G., Hugenberg, K., Bernstein, M. J., & Sacco, D. F. (2012). Perception and motivation in face recognition: A critical review of theories of the cross-race effect. *Personality and Social Psychology Review*, *16*, 116–142. doi: 10.1177/1088868311418987