SHORT NOTE

Outgroup homogeneity effect in perception: An exploration with Ebbinghaus illusion

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An outgroup homogeneity (OH) effect implies that outgroup members are perceived to be more similar than ingroup members. At present, however, it is not clear whether the OH effect is truly perceptual. Here, we used an Ebbinghaus illusion to demonstrate the OH effect in perception. Participants were presented with one central face that was surrounded by four surrounding faces. The central face was judged to be smaller as the size of the surrounding faces increased, thereby demonstrating an Ebbinghaus illusion. As predicted, however, this illusion was significantly greater when the faces allegedly belonged to an outgroup than when they allegedly belonged to an ingroup. This perceptual OH effect bore no significant relationship with cognitive OH measures. The perceptual versus cognitive OH effects might therefore be mediated by separate mechanisms.

Key words: Ebbinghaus illusion, face, outgroup homogeneity effect, perception.

Introduction

It has been demonstrated that individuals judge members belonging to a group different from their own (i.e. outgroup members) as less variable than members of their own group (i.e. ingroup members) – a tendency known as the outgroup homogeneity (OH) effect (e.g. Judd, Ryan, & Park, 1991; Park & Judd, 1990). This effect has been repeatedly demonstrated (see Boldry, Gaertner, & Quinn, 2007 for a review). So far, however, all demonstrations of this effect are based on cognitive judgments, such as a stereotype task, where the ratio of group members who possess stereotypic traits is estimated, leaving open the question of whether the OH effect might occur in perception. Here, we addressed this question by using the Ebbinghaus illusion – a perceptual illusion whereby the size of a target stimulus depends on the size of surrounding stimuli that belong to the same class. Importantly, this illusion is known to depend on perceived similarity among the stimuli (Coren & Enns, 1993; Coren & Miller, 1974; Stapel & Koomen, 1997).

In a typical Ebbinghaus procedure, a target stimulus is surrounded by several filler stimuli. Participants report the size of the target while ignoring the fillers. It has been shown that the perceived size of the target varies as a function of the size of the fillers such that the target is perceived as smaller (or larger) as the size of the filler stimuli increases (or decreases). This perceptual illusion results because indi-

viduals draw comparisons between the target and the fillers and these comparisons in turn produce a perceptual contrast effect. As might be expected from the hypothesis that similar stimuli are more likely to be compared (Festinger, 1954), this illusion becomes stronger when all the stimuli are similar to one another (Coren & Miller, 1974). For example, the illusion is stronger when the target and context stimuli share similar physical features (e.g. they are all circles) than when they do not (e.g. the central circle is surrounded by squares). Of importance, the similarity effect has been demonstrated even when the similarity is defined not by physical stimulus features, but by social categories (e.g. Pickett, 2001; Stapel & Koomen, 1997).

With Ebbinghaus configurations composed of faces of different sizes, Stapel and Koomen (1997) found that an Ebbinghaus illusion was greater in magnitude if the faces allegedly belonged to the same social category than if they allegedly belonged to different social categories. Pickett (2001) hypothesized that members of a cohesive group are perceived as more similar to one another than members of a nominal group. Adopting the procedure of Stapel and Koomen, Pickett demonstrated that the Ebbinghaus illusion is greater if the faces belong to a highly cohesive group (a sorority) than when they belong to a nominal group (people born in May).

Because the Ebbinghaus illusion is fundamentally perceptual rather than judgmental (Coren & Miller, 1974), it would enable us to carry out a powerful test of a perceptual OH effect. If the OH effect should happen in perception as well as in cognitive judgment, the magnitude of the Ebbinghaus illusion would vary as a function of the group membership of the faces of people that constitute
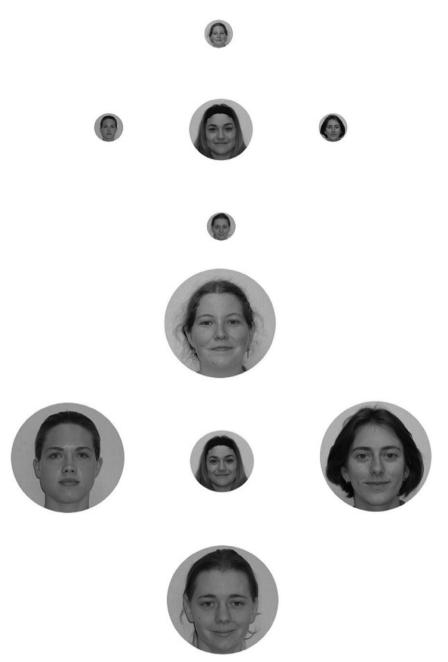
Figure 1 Example of Ebbinghaus configurations used in the present study.

Ebbinghaus configurations. The effect should be greater if the faces of the people belong to an outgroup than if they belong to an ingroup.

Based on the previous studies cited above (Pickett, 2001; Stapel & Koomen, 1997), we developed multiple Ebbinghaus configurations with faces of young adults (Fig. 1). The faces were labelled as members of a sports team in the participants' own university (University of Michigan) or members of a sports team from its archrival (Ohio State University). The group affiliation of each face was indicated by the colour of the background surrounding each face.

Thus, the faces were presented on a blue or a red background depending on their group membership being Michigan or Ohio State. Our pretest had shown that the background colours per se had no effect on the size of the Ebbinghaus illusion in the absence of group affiliation information. Participants were asked to view each set and estimate the size of the central face. To enhance our interpretation of the results, we included several additional measures, including recognition judgments of the faces, similarity judgments of people shown as stimuli, and similarity judgments of people in the respective universities in general.

Method

Participants

Fifty-one undergraduates at the University of Michigan (16 females and 35 males) participated in the experiment. Participants received course credits for their participation, and were tested individually. After arriving in the testing room, participants were informed that the aim of the study was to examine perceptions of groups.

Procedure

First, participants carried out an Ebbinghaus illusion task. On each trial, participants were presented with a set of five circles, each of which contained a different face photo (see materials below for more details). The circles were arranged such that a target circle was surrounded by four filler circles. The school affiliation of each member was indicated by the colour of the circles. During the illusion task, each set was presented for three seconds. Participants were instructed to look at the central circle and estimate the length of its diameter. After viewing the stimuli, they were shown a horizontal line. Participants indicated their estimate by marking the appropriate distance from the left edge of the line. This is the procedure used by Pickett (2001). Participants were asked not to use their hands to estimate the length of the diameter of the central circle. There were 32 trials following eight practice trials.

Upon completion of the Ebbinghaus illusion task, participants worked on a filler task: They were asked to subtract 7 from 1000 and repeat the subtraction for 2 minutes. They were then given a recognition test of the faces presented in the first stage. Participants were presented with 40 faces with no background colour on their computer screen, one at a time, and asked to indicate whether each face had been presented in the first task. Both accuracy and speed were emphasized. Response time was measured in milliseconds from the onset of each face. Half of the 40 faces had actually been presented in the illusion task, and the remaining faces were new (called fillers).

Next, participants were presented with all the sets of five faces used in the illusion task. For each set, participants were asked to think about the personalities, attitudes, preferences, hobbies, values, and other characteristics of the five people and then to report the perceived similarity among the five people by using a 7-point scale (1 = very dissimilar, 7 = very similar). Whereas about half of the participants (26) did the similarity task, the remaining half did not. Participants were also asked to indicate, on a 7-point rating scale, perceived similarities among people at the University of Michigan and those at Ohio State University in terms of both 'values' and 'behaviours'.

Materials

Facial photos of 40 young American adults were used. The faces were divided into two sets. In each set, half of the faces were female, while the remaining faces were male. Participants were shown one set of faces in the Ebbinghaus illusion task, and the other set as fillers in the recognition task. For each set, two combinations of five faces were used for each gender. Half of the combinations of female and male faces were assigned to Michigan and the other half to Ohio State by changing the background circle to each school's colour (blue for Michigan and red for Ohio State). As noted earlier, our pretest had shown that the colours per se in the absence of group affiliation information had no effect on the magnitude of the Ebbinghaus illusion. The assignment was counter-balanced so that any effects of ingroup versus outgroup cannot be attributed to specific faces used in the two conditions. For each combination of faces, four types of configurations [2 types of sizes of central circles (2.3 cm or 2.7 cm) × 2 types of surrounding circles (4.0 cm or 1.0 cm)] were used. Thus, there were 16 combinations of five faces for each set in total [= 2 (gender) × 2 (group) × 4 (circle configuration)] and, as the set was repeated twice, the total number of the trials was 32.

Results

Ebbinghaus illusion task

We hypothesized that the magnitude of the Ebbinghaus illusion, wherein the central circle is perceived as larger (or smaller) as the size of the surrounding circles decreases (or increases), would be greater for the sets comprising outgroup members (i.e. Ohio State) than sets comprising ingroup members (i.e. Michigan). We carried out an ANOVA on the estimated width of the central circle with one between-subjects variable [participants' gender (female and male)] and three within-subjects variables [group (Michigan or Ohio State), the size of the surrounding circles (larger and smaller), and the stimulus' gender (female or male)]. The main effect of the size of the surrounding circles was significant ($F_{1,49} = 10.74$, $p < 0.005$). The central circles were estimated to be larger when surrounded by smaller circles than when surrounded by larger circles (Ms = 2.19 cm *vs* 2.14 cm), thus demonstrating an Ebbinghaus illusion.

As predicted, there was a significant interaction between the size of the surrounding circles and group membership, $F_{1,49} = 4.63$, $p < 0.05$. As an index of the size of the illusion, we calculated the increase in estimated size for the central circles when they were surrounded by smaller circles, relative to when they were surrounded by larger circles. Consistent with our hypothesis, this illusion index was significantly larger for the outgroup (Ohio State) sets than

for the ingroup (Michigan) sets (Ms = 0.62 mm *vs* 0.34 mm). This is a clear demonstration of a perceptual OH effect. The mean size of the Ebbinghaus illusion in this study was quite similar to that reported in Pickett (2001). There was no interaction with participants' gender, $p > 0.10$

Recognition task

If cognitive representations of outgroup members were less differentiated or less elaborate than those of ingroup members, recognition judgments for outgroup members might be less accurate and require more time than recognition judgments for ingroup members. Although outgroup members tended to be less accurately recognized than were ingroup members, a 2 (gender) × 2 (group) ANOVA showed no significant main effect of group, Ms = 53.7 % versus 59.0 %., $F_{1,49} = 1.11$, $p > 0.20$. The predicted effect of group membership was observed for response time, however. The response time for correct recognition responses was significantly longer for the faces assigned to the outgroup than those assigned to the ingroup, Ms = 1505 ms versus 1410 ms, $F_{1,49} = 4.13$, $p < 0.05$.

Similarity judgment

In similarity judgment, characteristics of five group members were judged as somewhat more similar to each other if they were outgroup members than if they were ingroup members. Although consistent with our predictions, the pattern was only marginally significant, Ms = 4.89 versus 4.37, $F_{1,25} = 3.01$, $p < 0.10$. We also asked participants to rate the similarity of the students in each of the two universities with respect to both 'values' and 'behaviours'. The results were very similar across the two dimensions. The overall mean similarity scores tended to be higher for the outgroup (Ohio State) than for the ingroup (Michigan) although the difference was again only marginally significant, Ms = 3.52 versus 3.13, $F_{1,49} = 3.28$, $p < 0.08$. To ensure that this difference is due to the ingroup-outgroup manipulation, not a reflection of a general belief that members at Ohio State University are more similar to each other than members of the University of Michigan, we asked 23 European American undergraduates at a state university in the same region (University of Wisconsin) to judge similarity in both values and behaviours for University of Michigan students and Ohio State students. Similarity ratings were no different between Michigan and Ohio State (Ms = 3.78 for Michigan and 3.72 for Ohio State, $F < 1$). This result suggests that the intergroup context had an influence on the subjective judgment of similarity.

Correlations among the measures

For exploratory purposes, we computed an index of OH for each participant by subtracting the ingroup mean from the

outgroup mean for both the illusion size and the two cognitive measures (similarity judgments). In all cases, positive scores indicate an OH effect. The perceptual measure of the OH effect had no correlation with either of the two cognitive measures of the OH effect ($r_s = 0.23$ and -0.21, *ns*).

Discussion

The present study demonstrated that the size of an Ebbinghaus illusion was greater when stimulus faces of people belonged to an outgroup than when they belonged to an ingroup. Moreover, we also found a marginally significant OH effect in two cognitive measures.

The perceptual OH effect observed here suggests that influences of group-related beliefs go far beyond higher-order cognitive judgments. They occur at implicit and perceptual levels. The present work is thus in line with the idea of *New Look*, namely, that perception is significantly affected by endogenous factors such as expectations, values, and needs (Bruner & Goodman, 1947). Future work is needed to further examine the generality and validity of the perceptual OH effect with experimental manipulation of group membership (e.g. minimal group paradigm). If mere social categorization is sufficient to elicit the perceptual OH effect, similar results should be observed even when participants are assigned to artificially constructed groups.

Some unresolved issues limit the generality of the current results. We found OH effects in both the cognitive measures (similarity judgments) and the perceptual OH measure. Nevertheless, the two types of OH effect were not correlated. This might simply mean that the measures lacked reliability. Alternatively, these different measures might implicate different psychological processes even though the outcome (the OH effect) is very similar across the measures. Whereas our cognitive measures tap semantic knowledge about ingroup and outgroup members, the perceptual measure (the Ebbinghaus illusion) will depend on perceptual impressions of ingroup and outgroup members.

To conclude, the present work provided initial evidence suggesting that an OH effect can happen at a perceptual level. Further investigation is needed to establish the generality of the perceptual OH effect. We believe, however, that the current results deserve serious attention because it unequivocally shows a strong effect of social beliefs on perception.

Acknowledgements

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