دراسة تجريبية عن استحواذ المثيرات الاجتماعية على الانتباه

طارق نور الدين محمد
إسراء فريح شمس

ملخص: لقد تناولت الدراسة الحالية معرفة تأثير بعض المثيرات البصرية التي تؤدي دوراً مهماً في عملية التواصل الاجتماعي بين الأفراد. وركزت على التواصل غير اللفظي من خلال تعبيرات الوجه وحركات أعضاء الجسد البشري. وتضمنت الدراسة إجراء أربع تجارب اعتمدت على الأساليب التقليدية لعلم النفس التجريبي للتحقق من أهداف الدراسة، التي تمثلت بمعرفة إذا ما كانت أعضاء الجسد وتعبيرات الوجوه البشرية تستحوذ على حيز من عملية الانتباه الخاصة بنا. واستخدم نموذج البحث البصري المشار إليه بدراسة (Langton et al., 2008). كل من المثيرات المستخدمة عرضت على أفراد عينة الدراسة التي ظهرت على شكل تصنيف دائري. وحددت مهمة أفراد العينة في البحث عن الفراشات خلال التجربتين الأولى والثانية. وبدلت مهمة أفراد العينة ليكون البحث عن الوجوه البشرية خلال التجربة الثالثة، وأعضاء الجسد البشري خلال التجربة الرابعة. لقد أسفرت النتائج أن كلاً من الوجوه البشرية وأعضاء الجسم تستحوذ على حيز من عملية الانتباه في ظل غياب الفراشات. وهذا يدل على وجود نوع من المنافسة بين الفراشات وأعضاء الجسد والوجوه البشرية. وتدلل تلك النتائج على أن كلاً من الوجوه البشرية وأعضاء الجسد تؤدي دوراً مهماً بعملية التواصل الاجتماعي بين الأفراد.

المصطلحات الأساسية: الإدراك البصري، نموذج البحث البصري، لغة الجسد، الوجوه البشرية.

Attention Capture by Faces, and Human Bodies

Tarik N. Mohamed[*]
Esraa F. Shams[**]

Abstract: Four Experiments were conducted to examine if bodies capture attention similar to faces. A visual search paradigm was adopted from Langeton et al. (2008) study. Faces and bodies were presented upright (Exp.1a) or inverted (Exp1b). Participants were instructed to respond to the presence of butterflies, while face or body stimuli presented as one of the distractors. In Experiments ($2a_{\&}b$) participants were instructed to respond to either face or body targets respectively, while butterfly presented as one of the distractors. Results showed that attentional capture phenomena not only related to faces but also extend to bodies, but this advantage was totally vanished when the target was present. Results of Experiment 2a & b show advantages of attentional capture of butterflies stimuli when face or body targets are absent. These findings showed that there are features in common between faces and bodies. Faces and bodies capture attention, and have a classification advantages.

Key words: Keywords: Visual search paradigm, Face, Body, Attention Capture.

Introduction

Faces and human bodies attracted a large number of investigations and raised many discussions during the past decades. However, those stimuli are incredibly informative and a single glance provides much information about age, gender, ethnicity, and emotion. Researchers in the field of experimental psychology are interested in understanding separate and shared cognitive processes underlying face and body

* Department of Psychology, Sohag University, Sohag, Egypt.
** Tadwai Medical Center, Doha, Qatar.

perception. However, Perception of the above mentioned stimuli may be fundamentally different from the perception of inanimate objects such as buildings and furniture (e.g., Leder & Bruce, 2000; Maurer, Le Grand, & Mondloch, 2002).

Prior studies showed that faces and bodies may be carrying a lot of information that facilitate social communication between humans (Haxby, Hoffman, & Gobbini, 2002). For instance, facial expression conveys both emotional status and intention of the communicator. Consequently, a better understanding of these emotions leads to better communications between humans. Similarly, understanding the gestures of the human bodies, help us to avoid unpleasant situations. Therefore, many of studies have been conducted on faces and bodies, in the last decades, showing that there are many properties in common between both of them.

First of these common properties showed that faces and bodies share a number of abstract configural properties that make the perceptual system treat them similarly, for instance, all faces share the same set of parts (i.e. eyes, nose, mouth), as do all bodies (i.e. arms, legs, torso). Therefore, the distinctions depend on the exact shape and position of component parts (Reed, Stone, Bozova, & Tanaka, 2003; 2006; Stekelenburg & de Gelder, 2004; Slaughter, Stone, & Reed, 2004), which totally differ from the perceptual distinction of other objects, such as, buildings and furniture, which are processed in a part-based manner (as suggested by Diamond & Carey, 1986; Biederman, 1987; Tanaka & Farah, 1993).

Second: Event related potentials studies, which measure the timing of the brains electrical responses to visual stimuli, showed that the human brain responds differently to either faces or bodies than to other objects within 170 ms for faces and 190 ms for bodies after they are presented (For more details see, Thierry et al., 2006; Downing, Chan, Peelen, Dodds, & Kanwisher, 2006), with, increasing the amplitude of the neuro-cognitive components, in above mentioned times of brain electrical response for these stimuli compared to other visual objects.

Third: Functional magnetic reasoning imaging studies showed that there are regions in the human brain which strongly and selectively respond to either faces (Aguirre, Singh, & D'Esposito, 1999; Amedi, von

Kriegstein, van Atteveldt, Beauchamp, & Naumer, 2005) or human bodies (Peelen & Downing, 2006; Taylor, Roberts, Downing, & Thierry, 2010), and differ from the regions which respond to other objects. Interestingly some of these regions overlapping each other, lead to responding to faces and bodies (Morris, Pelphrey, & McCarthy, 2006).

Fourth: Prior studies showed that faces can grab our attention more easily than other stimuli do, in the sense of increasing the reaction times (RTs) of response processing when these stimuli were presented as distractors (e.g., Bindemann, Burton, Langton, Schweinberger, & Doherty, 2007; Brebner & Macrae, 2008; Langton, Law, Burton, & Schweinberger, 2008; Ro, Friggel, & Lavie, 2007; Theeuwes & Van der Stigchel, 2006). The study of Langton et al. (2008) showed that the presence of an upright distractor neutral face slows the search process for a butterfly target while a butterfly distractor does not affect the search process for a target face, suggesting that neutral faces capture attention automatically. Replication of these findings was previously reported in Theeuwes et al., (2006) study, which examined neutral faces and attentional capture, using occurrence of inhibition of return. Participants were made a speed saccade to the location of previously presented images of neutral faces and appliances. Results showed that faces do have an ability to engage attention.

Interestingly, many other studies (Fox, Russo, & Dutton, 2002; Georgiou et al., 2005), showed that emotional faces capture attention. One crucial difference between emotional and neutral faces, is that attention capture for emotional stimuli could be interpreted due to the emotion factor as was demonstrated in the study of (Vuilleumier & Schwartz, 2001), and emotional facial expression capture attention. Consequently, attentional capture effects found in these studies (Fox et al., 2002; Georgiou et al., 2005) could not be due to the specialty of faces stimuli. To avoid that, in the current study we used neutral faces, to examine if this effect of attentional capture is related to the specialty of face stimuli, and not to other factors.

It has been controversial in the literature if human bodies capture attention in an identical manner to faces. However, few papers have discussed this issue. In the study of (Downing, Bray, Rogers, & Childs, 2004), the authors examined whether unexpected, task-irrelevant human body stimuli capture awareness when attention is occupied by a primary

task. Silhouettes and stick figures of human bodies were compared to object silhouettes, and scrambled silhouettes of bodies, body parts, and objects. Participants were significantly better able to detect a human figure relative to the control stimuli. These results suggest that the human body, like the face, may be prioritized for attentional selection. In line, the study of Ro et al. (2007), examined whether body parts and faces engaged attention more than other objects. Findings showed that faces and body parts engaged attention. One critical point in this study was that the authors compared 3 experiments using faces with the results, with one experiment using body parts. In contrast, Mohamed's (2012) study, used identical procedures of Ro et al. study, combining faces and body parts in the first experiment; and in the second experiment, the author distinguished between active and passive parts. Results showed that faces and human body parts are processed differently. Additionally, there is no difference between Active body parts (e.g., Hands) or passive parts (e.g., Torso), except that there is a clue that active parts might capture attention more than passive parts.

Up to date, there has not been any direct behavioral evidence to examine if human bodies have a similar pattern of faces and capture attention in an identical manner. Thus, the current study is interested to answer the following questions:

1- Do faces and human bodies capture attention in an identical manner?
2- Can the attention capture effect, if present, be vanished for inverted Stimuli?
3- Does the face or body capture attention effect belong to these stimuli or other animates objects?
4- Do faces and bodies have a classification advantages, in an identical pattern?

To answer all of the above-mentioned questions, we ran four experiments, one experiment for each question, using visual search paradigm adopted from the study of (Langton et al., 2008). The importance of this study could be specified in the following points:

1- The study investigated a new category represented in human bodies, and tested whether faces and human bodies capture attention in an identical manner. However, this relation does not test before using the above mentioned model, as far as we know.

2- The study examined whether this effect of capture attention is related to upright stimuli or could be extended to inverted stimuli, especially that some studies showed an inversion effect for point-light walker stimuli (e.g., Jokisch, Daum, Suchan, & Troje, 2005)
3- It determined whether attentional capture phenomenon is specific to faces/ Bodies or could be extended to other animate objects such as, butterflies.
4- It sought to specify whether both faces and human bodies have a classification advantages in an identical manner.

Experiments 1a and 1b

In Experiments 1a and 1b, we examined whether faces or bodies capture attention in an identical manner, using a visual search paradigm and replicating the same procedures of (Langton et al., 2008) study. Additionally, we examined whether this effect of attentional capture is specific to upright stimuli or could be extended to inverted stimuli. It is worth noting that in the current experiment, we were using body category as an ideal competitor to face stimuli, to examine if human body has a similar pattern to faces and capture attention. There is no evidence in the literature that this question was addressed before. In the current experiment we included either faces or human bodies, and participants were instructed to decide if the butterfly is present amongst a circular array of six visual objects. Face or body presented 33.3% each of the whole numbers of trials. The difference between Experiments 1a and 1b was that the arrays were rotated $180^{o.}$

Method

Participants:

24 participants (50% males) Age between 18 and 30 years old (M = 23.6, SD = 3.7) participated in the experiments from university of Sohag, Egypt. All participants were selected randomely with specific criteria that all of them were right handed and reported normal or corrected to normal vision Acuity.

Apparatus and materials

Experiments were run on a Dell computer with a 15.4 inch colour

monitor set at a 1024x768 pixel, and 32 bit colour quality, using E-Prime Professional 0.2 software (Psychology Software Tools). Stimuli presented in a circular array pictured greyscale objects on a white background. Horizontal and vertical stimulus size was 140x140 Pixels for six categories (Plants, House Plants, leaves, flowers, butterflies and faces), while body Category was resized to 140x240 pixels. We used 8 images of faces (4 female faces) from CAL/PAL Database (Minear & Park, 2004). 8 images of bodies (4 female bodies) from a set of stimuli were used in a previous study of Mohamed et al.(2011). 8 images of butterflies were obtained from the study of Schweinberger et al.(2004), and 16 images of each other categories obtained from different sources. All images were edited using Adobe Photoshop (version 9.02). Spatial frequency of stimuli was well-controlled using Image3 program. The centre of each object was 4.3ºof visual angle from a viewing distance of 60 cm. Responses were made on a two-button response on Standard English keyboard.

Design and procedures

The materials were tested in a within-subjects design with two factors: target (present vs. absent) and Distractors (Face vs. Body vs. Absent). Each trial began with a fixation cross for 1000 ms followed by the presentation of the stimulus array (see Fig. 1). Participants were instructed to identify as quickly and accurately as possible whether or not a butterfly was present in each array and to make their responses by pressing either the "6" key or the "4" key on a standard keyboard (Numerical part), which terminated the display. Following the practice block, which continued until the participants performed the task accurately, three blocks of 720 trials were run (240 trials contained faces as one of the distractors, 240 trials Contained body). 360 trials for target present.

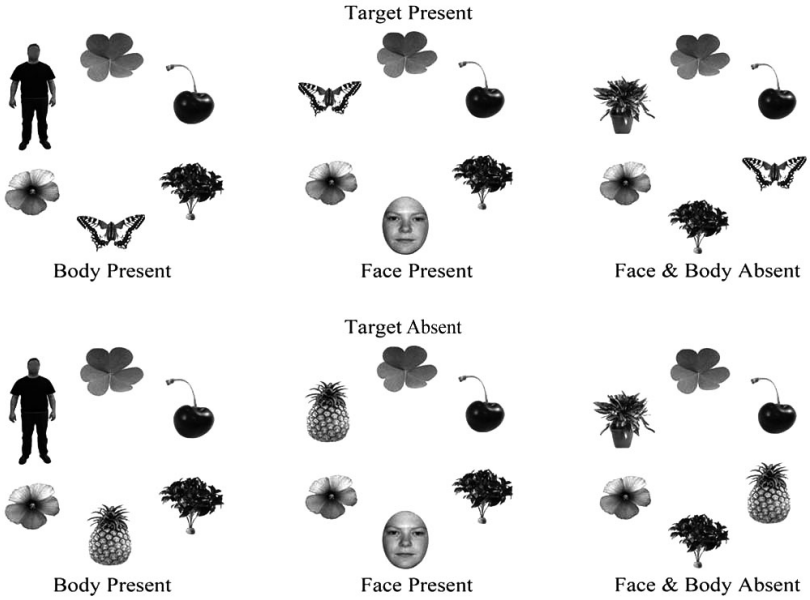

Figure1. Examples of body present (left panel), face present (middle panel), and face & body absent (right panel) stimulus array used in the experiment. Upper part when the target is present, while the lower part when the target is absent

Results

RTs

We removed incorrect responses (1.9%), and responses that were slower or faster by 2SD of each subjects mean (2.3%) from the RT analysis, using Tukey's outlier corrections to keep homogeneity of variance in all RTs Data.

Repeated measure ANOVAs showed a main effect of Target presence $F(1, 23) = 79.29$; $p < 0.001$, with faster response when target present (M = 553.07) vs. absent (M = 642.91), and an interaction of target by distractors, $F(2, 46) = 6.86$; $p < 0.01$. To solve this two way interaction, we conducted additional analysis when the target present versus absent, by using one-way ANOVA. When the target was present, results showed a main effect of distractors $F(2, 46) = 5.22$; $p < 0.05$, with longer RTs when face and body absent (M = 556,79) vs. face (M = 555.94) or body present (M = 546.49). One-way ANOVA when the target absent showed a main effect of Distractors $F(2, 46) = 5.00$; $p < 0.05$, with

longer RTs when face (M = 645.68) or body (M = 646.99) present vs. absent (M = 636.07). T-test showed that there are advantages of attention capture when face $t(23) = 2.64$; $p = 0.02$ or body $t(23) = 2.95$; $p = 0.01$ present vs. when absent.

These findings stand in contrast to Langeton et al., 2008, a study which found that attention capture advantages appear when the target category is present. In contrast, the current experiment found that face and body capture attention in the absence of target category. These findings suggested that some of attentional advantages might exist for the presence of the butterflies. We examined this possibility in Experiment 2 a&b, in which butterflies were presented as distracters, while faces and bodies were presented as targets, to investigate if butterflies capture attention are similar to faces and human bodies, or attentional advantages are specific to faces and bodies. However, this effect of attentional capture, which has been reported in this experiment, could be interpreted in terms of the presence of butterflies with faces or bodies that makes inhibition to perceive these stimuli efficiently. Consequently, faces and bodies could not capture attention in the presence of butterflies, and vice-versa. It means that butterflies might have some attentional advantages. Experiment 2 will address these issues in more details.

Results of Experiment 1b showed a main effect of Target presence $F(1, 23) = 94.33$; $p < 0.001$, with longer RTs when inverted target is absent (M = 626,52) vs. present (M = 540,50), Distractors $F(2, 46) = 23.48$; $p < 0.01$,with longer RTs for inverted body (M = 593.78) vs. inverted face (M = 576.09) or inverted other categories (M = 577.14). No other main effects or interactions were reported.

Results of Experiment 1b for faces are in line with other previous findings which showed that face capture attention advantage is completely lost when faces are presented upside-down (Bindemann et al., 2007; Langton et al., 2008; Palermo & Rhodes, 2003; Bindemann & Burton, 2008). Surprisingly results of inverted body still shows attentional capture advantage. One Possible explanation for that could be the height of those stimuli when presented upside-down, thus it is difficult for the attentional system to ignore these stimuli. Another possibility has come from studies of point-light walker stimuli (Jokisch et al., 2005), which showed that inversion effect was present for point light walker stimuli, while the face information is completely absent. These

findings assume that other body parts (e.g., legs) might play an important role in the perception of human bodies. It might be that legs when presented in the position of the head for inverted body images lead to capture attention. This interpretation is speculative. Our future studies, shall be address these issues in more details.

Table1. Mean Reaction Times (RTs) and Accuracy (ACC) in each of the Conditions in Experiment1a$_{\&}$b, where Participants Searched for Butterfly Targets.

Exp.		Target Present			Target Absent		
		Face Present	Body Present	Face & Body Absent	Face present	Body Present	Face & Body Absent
Exp.1a	RTs	555.94	549.99	556.79	645.68	646.99	636.07
Exp.1b	RTs	533.18	549.73	538.59	618.99	637.83	620.75

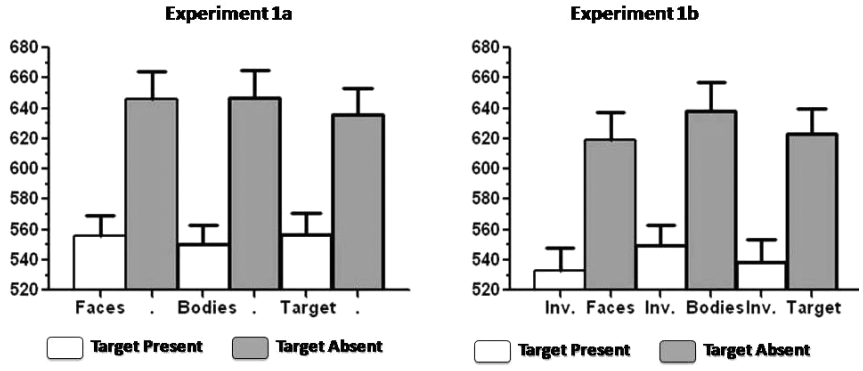

Figure 2. Mean Reaction Times for all categories used in Experiment 1. Left figure for Experiment 1a.Right figure for Experiment 1b. White bars when the target present trails. Gray bars when the target absent

Experiments 2a and 2b

In the Experiment 2, we examine whether butterfly capture attention in an identical pattern similar to faces or bodies or whether butterfly has no influences on the task process, when faces and bodies are in target position.

Additionally, we explained why this effect of attentional capture which was observed in the Experiment 1a was present in the absence of butterflies. Besides, we examined whether faces and human bodies have classification advantages in an identical manner. All procedures are identical to Experiment 1, EXCEPT the number of trials on each individual experiment is 480 trials. The participants were instructed to decide if the face was presented amongst a circular array of six visual objects.

Results

RTs

We removed incorrect responses (1.6 %), and responses that were slower or faster by 2SD of each subject mean (1.9%) from the RT analysis, using Tukey's outlier corrections to keep homogeneity of variance in all RTs Data..

ANOVAs showed a main effect of Target presence $F(1, 23) = 38.72$; $p < 0.001$, with faster response to face present (M = 426.52) compared to absent (M = 461.86), Distractors $F(1, 23) = 4.87$; $p < 0.05$, with slower RTs when butterfly present (M = 445.95) versus absent (M = 442.43), and an interaction of target by distractors, $F(1, 23) = 8.26$; $p < 0.01$. Additional analysis was conducted to solve up two way interaction, when face is present versus absent. Results showed that there is a main effect of distractors when face is absent $t(23) = 3.23$; $p = 0.004$,with slower RTs when butterfly was present (M = 465.59) vs. Absent (M = 458.13). However this effect is completely absent when the target is present $t(23) = -0.23$; $p = 0.823$.

Results of Experiment 2a showed that butterflies capture attention when faces are absent. These findings interpreted the effect which was reported in Experiment 1a. In that, butterflies when presented with faces or bodies it might inhibit the effect of attentional capture, and this is the reason of attentional advantages for faces and bodies which has been reported in the absence of butterflies. We realized that our interpretation is speculative, but there is evidence coming from studies of (Jacques & Rossion, 2004), which showed that the competition of two faces may decrease the Event related potentials component which termed N170. It

might be the same case here, in that butterflies inhibited the ability of face and bodies to capture attention. In contrast, when butterflies were absent, we found that this effect was pop-up.

Results of experiment 2a showed classification advantages which have been reported for faces, with faster RTs when face present vs. absent. These findings are in line with (Caldara, Rossion, Bovet, & Hauert, 2004; O'Toole et al., 1998; Langton et al., 2008), which showed classification advantages of faces.

Results of Experiment 2b Showed a main effect of Target presence $F(1, 23) = 42.16$; $p < 0.001$, with faster response when body present (M = 414.04) vs. absent (M = 449.95), Distractors $F(1, 23) = 5.53$; $p < 0.05$, with slower RTs when butterfly present (M = 434.10) versus absent (M = 429.88), and an interaction of target by distractors, $F(1, 23) = 13.69$; $p < 0.001$. To solve-up two way interactions, additional analysis was conducted when body was present versus absent. Results showed that there is a main effect of distractors when the body is absent $t(23) = 4.10$; $p = 0.001$,with slower RTs when butterfly was present (M = 454.52) vs. Absent (M = 445.37). However this effect is completely absent when the target is present $t(23) = -0.32$; $p = 0.75$.

Table2. Mean reaction times (RTs) and Accuracy (ACC) in each of the conditions in experiment2a&b, where participants searched for face or body targets.

Exp.		Target Present		Target Absent	
		Butterfly Present	Butterfly Absent	Butterfly Present	Butterfly Absent
Exp.2a	RTs	426.31	426.73	465.59	458.13
Exp.2b	RTs	413.68	414.40	454.53	445.37

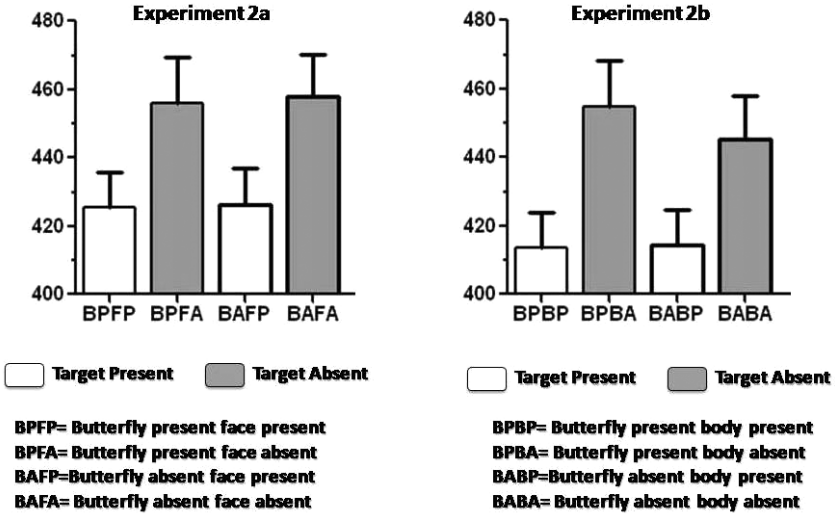

Figure 3. Mean Reaction Times for all categories used in Experiment 2. Left figure for Experiment 2a. Right figure for Experiment 2b. White bars when the target present trails. Gray bars when the target absent. Bottom the abbreviations used in the figures

Interestingly, results of experiments 2b shows another evidence for the specialty of human bodies, in that the human body is classified faster than other objects. These findings are in line with (Ro et al., 2007) findings. These findings combined with experiment 1a findings, suggested that faces and human bodies capture attention and are classified faster than other objects. The mechanism of classification advantages for faces is not clear-cut. However, this mechanism helps the attentional system to perceive those stimuli efficiently and accurately. Moreover, findings showed the same pattern of attention capture in that the response process takes long time when butterflies are present vs, absent. In conclusion, it seems that butterflies slow down attentional system to perceive bodies and faces when presented with butterflies due to competition effect, efficiently.

General Discussion

Findings of the current study reported that human faces and bodies captured attention, when butterfly targets were absent. However, this effect was completely absent when butterfly targets were present

(Exp.1a). We suggested that this effect, which has been reported in experiment 1a, might be interpreted in terms of the competition effect when faces or bodies were presented together with butterfly targets. Moreover, the presence of butterflies with faces/ bodies may inhibit the attentional system to perceive these stimuli accurately and efficiently. In contrast, when butterflies are absent, the attentional system is capable of perceiving these stimuli efficiently, and leads to prolong the response processing, and give the chance for faces and human bodies to capture attention. It is worth noting that faces, bodies and butterflies, were the only animate objects presented in the four experiments. We realized that our interpretation was speculative. Evidence for above mentioned interpretation came from findings of experiments 2a&b, which showed that butterflies engaged attention in the absence of face targets and body targets in an identical manner. In contrast, when faces and bodies targets were present no attentional advantages were reported for butterflies. The findings of experiments 2a&b combined with the findings of experiment 1a, suggest that faces and bodies are a special type of stimuli and capture attention when animate objects are absent. These results raised the hypothesis that bodies and faces might have distinct or specialized neural representations which may be also given priority for attentional selection. Surprisingly, current findings suggested that butterflies may be also given priority for attentional selection, and the competition between faces or bodies with butterflies may lead to slow down stimulus-driven attentions capture to all of these animate objects. Evidence for this has come from Event- related potentials studies, which measure the timing of the brains electrical responses to visual stimuli, which termed N170 and showed this component was diminished when faces in a competition with another face (Jacques & Rossion, 2007) or with greebles (Gauthier, Skudlarski, Gore, & Anderson, 2000; Gauthier, Tarr, Anderson, Skudlarski, & Gore, 1999; Rossion et al., 2000). Additionally, butterflies stimuli which we used in the current experiments showed some of the attentional advantages as has been reported in the study of (Schweinberger, Huddy, & Burton, 2004).

In contrast, to the results of (Langton et al., 2008), which showed that faces capture attention when the butterfly target is present vs.

absent. This discrepancy, which has been reported between current findings and results of Langeton et al is not clear- cut. One possible explanation, of this discrepancy is that we used a special type of butterflies stimuli, which showed some of attentional advantages. Consequently, conflict between faces or bodies and butterflies may inhibit the effect of attentional capture for faces, and human bodies, and accordingly, this effect of attentional capture could not pop-up in the presence of butterflies and vice-versa.

Another interesting and counterintuitive finding was reported in experiment 1b, which shows that inverted bodies engage attention, while this effect is absent for inverted faces. One clue for this effect has come from (Jokisch et al., 2005), study which showed an inversion effect for point- light walker stimuli (which similar to the body shape), when they presented up-side-down vs. upright. In particular, this type of above-mentioned stimuli did not include any of face information. Nevertheless, these findings suggested an important role for body parts (e.g., legs) in the perception of the body. Consequently, this could be the case for the attentional capture phenomenon which is related to inverted body. In particular, the visual system could not ignore the inverted human bodies regard to the exact shape position of legs which take the place of the head in body images, and the attentional capture effect could be interpreted in terms of the presence of the head parts. We concluded that, heads capture attention when presented in the correct position. Otherwise, when heads are not in the correct position the attentional system is engaged by body parts, in particular, legs, which take the position of the head. We realize that our interpretation for this effect is speculative. One evidence comes from previous report of (Mohamed, 2012) which showed that there is some evidence that active parts (i.e., hands and legs) might capture attention more than passive parts (i.e., Torso). Thus, the attentional system perceived inverted body in a special way. Another evidence has come from the study of (Minnebusch, Suchan, & Daum, 2009), which showed an electrophysiological inverted inversion effect for headless bodies. We concluded that human bodies are not only a special category, but the body parts are special too. This is in line with the conclusion of (Ro et al., 2007) that both faces and body parts are special categories of

interest for the visual system. These results combined with previous findings reported in the above-mentioned studies, have us conclude that faces, bodies and body parts are special categories which succeed in engaging attention. Moreover, the current study presents a behavioral evidence that bodies capture attention in a similar pattern to human faces, suggesting that there is attention capture advantages for faces and bodies.

Results of Experiments 2a showed that there is a classification advantage for faces, with faster RTs when face present vs. absent. In line with previous studies which showed that faces classified more than other objects (Caldara et al., 2004; O'Toole et al., 1998; van Rijsbergen & Schyns, 2009), which showed that face stimuli are easily to be perceived accurately, and efficiently. We suggested that there is a mechanism that stands behind the perception of faces which helps to classify it quickly.

Interestingly, experiment 2b showed that body images have a classification advantage, with faster RTs when body's targets present vs. absent. These results suggested that both faces and human bodies are processed differently from other visual objects. It might be that there is a mechanism that helps the perception system to perceive faces and bodies more accurately and efficiently in contrast, to the mechanism that perceived other visual objects. This interpretation should be further examined. Our Future studies shall address all of these issues in more details.

Conclusion

We concluded that faces, human bodies and body parts are a special type of stimuli, which the visual system perceived differently to other visual object s. Here, we presented new evidence that both faces and bodies capture attention in the absence of butterflies. Additionally, we found attentional advantages for inverted bodies, suggesting an important role of body parts. Moreover, we found that faces and human bodies are processed faster than other visual objects. In conclusion, faces, bodies and body parts are special categories which capture attention and have classification advantages. The current study presented evidence, using a behavioural model that both faces and human bodies capture

attention and both have a classification advantages. However, there is no study, as far as we know which proved that.

Reference

Aguirre, G. K., Singh, R., & D'Esposito, M. (1999). Stimulus inversion and the responses of face and object-sensitive cortical areas. *Neuroreport, 10,* 189-194.

Amedi, A., von Kriegstein, K., van Atteveldt, N. M., Beauchamp, M. S., & Naumer, M. J. (2005). Functional imaging of human crossmodal identification and object recognition. *Experimental Brain Research, 166,* 559-571.

Biederman, I. (1987). Recognition-By-components - A Theory of human image understanding. *Psychological Review, 94,* 115-147.

Bindemann, M. & Burton, A. M. (2008). Attention to upside-down faces: An exception to the inversion effect. *Vision Research, 48,* 2555-2561.

Bindemann, M., Burton, A. M., Langton, S. R. H., Schweinberger, S. R., & Doherty, M. J. (2007). The control of attention to faces. *Journal of Vision, 7.*

Brebner, J. L. & Macrae, C. N. (2008). Faces, flowers and football boots: Capacity limits in distractor processing. *Cognition, 107,* 718-728.

Caldara, R., Rossion, B., Bovet, P., & Hauert, C. A. (2004). Event-related potentials and time course of the 'other-race' face classification advantage. *Neuroreport, 15,* 905-910.

Diamond, R. & Carey, S. (1986). Why faces are and are not special - An effect of expertise. *Journal of Experimental Psychology-General, 115,* 107-117.

Downing, P. E., Bray, D., Rogers, J., & Childs, C. (2004). Bodies capture attention when nothing is expected. *Cognition, 93,* B27-B38.

Downing, P. E., Chan, A. W. Y., Peelen, M. V., Dodds, C. M., & Kanwisher, N. (2006). Domain specificity in visual cortex. *Cereb Cortex, 16.*

Fox, E., Russo, R., & Dutton, K. (2002). Attentional Bias for Threat: Evidence for Delayed Disengagement from Emotional Faces. *Cogn Emot., 16,* 355-379.

Gauthier, I., Skudlarski, P., Gore, J. C., & Anderson, A. W. (2000). Expertise for cars and birds recruits brain areas involved in face recognition. *Nature Neuroscience, 3,* 191-197.

Gauthier, I., Tarr, M. J., Anderson, A. W., Skudlarski, P., & Gore, J. C. (1999). Activation of the middle fusiform 'face area' increases with expertise in recognizing novel objects. *Nature Neuroscience, 2,* 568-573.

Georgiou, G. A., Bleakley, C., Hayward, J., Russo, R., Dutton, K., Eltiti, S. et al. (2005). Focusing on fear: Attentional disengagement from emotional faces. *Visual Cognition, 12,* 145-158.

Haxby, J. V., Hoffman, E. A., & Gobbini, M. I. (2002). Human neural systems for face recognition and social communication. *Biological Psychiatry, 51,* 59-67.

Jacques, C. & Rossion, B. (2004). Concurrent processing reveals competition between visual representations of faces. *Neuroreport, 15,* 2417-2421.

Jacques, C. & Rossion, B. (2007). Electrophysiological evidence for temporal dissociation

between spatial attention and sensory competition during human face processing. *Cerebral Cortex, 17,* 1055-1065.

Jokisch, D., Daum, I., Suchan, B., & Troje, N. F. (2005). Structural encoding and recognition of biological motion: evidence from event-related potentials and source analysis. *Behavioural Brain Research, 157,* 195-204.

Langton, S. R. H., Law, A. S., Burton, A. M., & Schweinberger, S. R. (2008). Attention capture by faces. *Cognition, 107,* 330-342.

Leder, H. & Bruce, V. (2000). When inverted faces are recognized: The role of configural information in face recognition. *Quarterly Journal of Experimental Psychology Section A-Human Experimental Psychology, 53,* 513-536.

Maurer, D., Le Grand, R., & Mondloch, C. J. (2002). The many faces of configural processing. *Trends in Cognitive Sciences, 6,* 255-260.

Minear, M. & Park, D. C. (2004). A lifespan database of adult facial stimuli. *Behavior Research Methods Instruments & Computers, 36,* 630-633.

Minnebusch, D. A., Suchan, B., & Daum, I. (2009). Losing your Head: Behavioral and Electrophysiological Effects of Body Inversion. *Journal of Cognitive Neuroscience, 21,* 865-874.

Mohamed, T. N. (2012). The Behavioral Relation of Classfication and Attention for the Preception of Social Stimuli. *Sohag Educational Studies, 31,* 1-23.

Mohamed, T. N., Neumann, M. F., & Schweinberger, S. R. (2011). Combined effects of attention and inversion on event-related potentials to human bodies and faces. *Cognitive Neuroscience, 2,* 138-146.

Morris, J. P., Pelphrey, K. A., & McCarthy, G. (2006). Occipitotemporal activation evoked by the perception of human bodies is modulated by the presence or absence of the face. *Neuropsychologia, 44,* 1919-1927.

O'Toole, A. J., Deffenbacher, K. A., Valentin, D., Mckee, K., Huff, D., & Abdi, H. (1998). The perception of face gender: The role of stimulus structure in recognition and classification. *Memory & Cognition, 26,* 146-160.

Palermo, R. & Rhodes, G. (2003). Change detection in the flicker paradigm: Do faces have an advantage? *Visual Cognition, 10,* 683-713.

Peelen, M. & Downing, P. (2006). Bold latency in FFA and EBA depends on object category. *Journal of Psychophysiology, 20,* 329-330.

Reed, C. L., Stone, V. E., Bozova, S., & Tanaka, J. (2003). The body-inversion effect. *Psychological Science, 14,* 302-308.

Reed, C. L., Stone, V. E., Grubb, J. D., & McGoldrick, J. E. (2006). Turning configural processing upside down: Part and whole body postures. *Journal of Experimental Psychology-Human Perception and Performance, 32,* 73-87.

Ro, T., Friggel, A., & Lavie, N. (2007). Attentional biases for faces and body parts. *Visual Cognition, 15,* 322-348.

Rossion, B., Gauthier, I., Tarr, M. J., Despland, P., Bruyer, R., Linotte, S. et al. (2000). The N170 occipito-temporal component is delayed and enhanced to inverted faces but not to inverted objects: an electrophysiological account of face-specific processes in the human brain. *Neuroreport, 11,* 69-74.

Schweinberger, S. R., Huddy, V., & Burton, A. M. (2004). N250r: a face-selective brain response to stimulus repetitions. *Neuroreport, 15,* 1501-1505.

Slaughter, V., Stone, V. E., & Reed, C. (2004). Perception of faces and bodies - Similar or different? *Current Directions in Psychological Science, 13,* 219-223.

Stekelenburg, J. J. & de Gelder, B. (2004). The neural correlates of perceiving human bodies: an ERP study on the body-inversion effect. *Neuroreport, 15,* 777-780.

Tanaka, J. W. & Farah, M. J. (1993). Parts and Wholes in Face Recognition. *Quarterly Journal of Experimental Psychology Section A-Human Experimental Psychology, 46,* 225-245.

Taylor, J. C., Roberts, M. V., Downing, P. E., & Thierry, G. (2010). Functional characterisation of the extrastriate body area based on the N1 ERP component. *Brain and Cognition, 73,* 153-159.

Theeuwes, J. & Van der Stigchel, S. (2006). Faces capture attention: Evidence from inhibition of return. *Visual Cognition, 13,* 657-665.

Thierry, G., Pegna, A. J., Dodds, C., Roberts, M., Basan, S., & Downing, P. (2006). An event-related potential component sensitive to images of the human body. *Neuroimage, 32,* 871-879.

van Rijsbergen, N. J. & Schyns, P. G. (2009). Dynamics of Trimming the Content of Face Representations for Categorization in the Brain. *Plos Computational Biology, 5*.

Vuilleumier, P. & Schwartz, S. (2001). Emotional facial expressions capture attention. *Neurology, 56,* 153-158.

Submitted: February 2014

Accepted: May 2014

Appendix 1

Accuracy

The accuracy analysis includes incorrect responses, and the responses that slower by more or less than 2SD of each subject mean. ANOVA for upright arrays showed a main effect of Target presence $F(1, 23) = 38.37$; $p < 0.001$, with more accurate when the target is absent (M = 0.99) compared to present (M = 0.96). No other effects or interactions. For Experiment 1b showed a main effect of target presence $F(1,23) = 60.89$; $p < 0.001$, with more accurate when the target is absent (M = 0.99) compared to present (M = 0.96). No other effects or interactions (*c.f.,* Table 3).

Table 3.

Exp.		Target Present			Target Absent		
		Face present	Body Present	Face & body Absent	Face present	Body Present	Face & body Absent
Exp.1a	ACC	0.96	0.96	0.95	0.98	0.98	0.98
Exp.1b	ACC	0.95	0.95	0.95	0.99	0.98	0.98

Results of Experiment 2a showed a main effect of Target presence $F(1, 23) = 9.23$; $p < 0.01$, with more accurate when the target is absent (M = 0.98) compared to present (M = 0.97). Results of Experiment 2b showed a main effect of Target presence $F(1, 23) = 13.85$; $p < 0.01$, with more accurate when the target is absent (M = 0.98) compared to present (M = 0.96), (*c.f.,* Table 4).

Table 4.

Exp.		Target Present		Target Absent	
		Butterfly Present	Butterfly Absent	Butterfly Present	Butterfly Absent
Exp.2a	ACC	0.97	0.97	0.98	0.98
Exp.2b	ACC	0.85	0.88	0.91	0.93