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Masked Famous Faces Influence Attention

Attentional Effects of Masked Famous Faces (But Not Names) and Subjective Evaluations of a Target Person

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Summary.—Two experiments are reported using a 1986 version of the dot-probe paradigm of MacLeod, Mathews and Tata, in which the masked subliminal faces of famous persons were differentially associated with attention depending on participants' attitudes towards the famous person. There was attentional avoidance of the faces of persons invoking high disgust (Exp. 1, $n = 20$) or dislike (Exp. 2) but attentional orientation towards the faces of persons invoking low disgust or liking. In Exp. 2 ($n = 28$) this effect was apparent for the faces but not the names of famous persons, despite evidence that the famous names were recognised without awareness. The aversion of attention from faces, but not the names of famous persons who are regarded in a negative light but who are not particularly threatening, may suggest an automatic tendency to avoid making eye contact with an undesirable person thereby avoiding unwanted social interaction.

Faces are extremely important social stimuli, conveying a wealth of information including the identity and emotional state of the possessor. Several previous studies have observed that faces capture attention more strongly than other stimuli (e.g. faces versus shapes in Vuilleumier, Sagiv, Hazeltine, Poldrack, Swick, Rafa, *et al.*, 2001; faces versus objects in Bindemann, Burton, Hooge, Jenkins, & de Haan, 2005; faces versus household appliances in Theeuwes & Van der Stigchel, 2006). An important factor affecting the salience of a face is its familiarity, and, accordingly, a familiar face is more likely to attract attention than an unfamiliar face (e.g., Devue & Bredart, 2008). Even new-born infants can show a preference for attending to familiar rather than unfamiliar faces when the faces are familiarised within the experimental context (e.g., Barrile, Armstrong, & Bower, 1999).

In a substantial body of research negative stimuli ‘attract’ or ‘hold’ attention more strongly than positive stimuli and consume more cognitive resources (e.g., Pratto & John, 1991; Hartikainen, Ogawa, & Knight, 2000; Armony & Dolan, 2002; Smith, Cacioppo, Larsen, & Chartrand, 2003; Most, Chun, & Widders, 2005; Milders, Sahraie, Logan, & Donnellon, 2006; Newsome & Zald, 2006; Li, Wang, Poliakoff, & Luo, 2007; Okon-Singer, Tzelgov, & Henik, 2007; see Kensinger, 2007, and Palermo & Rhodes, 2007, for reviews). The stronger attentional effect of negative stimuli compared to positive stimuli is often attributed to an evolved mechanism for paying particular attention to a potential source of threat to ensure individual survival. If faces are presented, those posing a threatening emotional expression have stronger effects on attentional capture or hold in non-clinical samples (e.g. Mogg & Bradley, 1999; Milders, *et al.*, 2006; Li, *et al.*, 2007; Carlson, Reinke, & Habib, 2009; West, Anderson, & Pratt, 2009).

Although not specifically reported in the literature, by analogy with the stronger attentional effects of threatening facial expressions it seems reasonable to predict that faces of famous people who invoke a negative evaluation would attract or hold attention particularly strongly—more so than famous faces with positive valence or unfamiliar faces. Further, there is evidence that famous faces can be recognised as specific individuals without participants’ awareness of their facial identity. For example, Banse (1999; 2001) exposed a famous face very briefly with forward and backward masking. He observed a priming effect on a subsequent stimulus word suggesting that the face had invoked an identity-specific affective response from the participant even though the participant was unable to consciously recognise the face. Similarly, Stone, Valentine, and Davis (2001) and Stone and Valentine (2004) presented faces of famous people for very brief exposure with forward and backward masking, and found that participant responses were influenced in systematic ways by their

affective attitude towards the famous person (recognised and rated in a subsequent, non-masked presentation). Given that famous faces can be recognised without participants' awareness of facial identity, it can be predicted that the faces of famous people with negative valence would attract attention even when perceived without awareness. This was supported by Milders, Sahraie, and Logan (2008) review in which they concluded that implicit experimental effects, e.g., those arising without awareness or intent, are stronger for negative than positive stimuli. The logical prediction is that the face of a famous person with negative valence, perceived without participant awareness of their identity, would be more likely to capture and/or to hold attention than the face of a famous person with positive valence. It would, therefore, be interesting to report an experimental paradigm in which the faces of famous people with negative valence reliably repel rather than attract attention. Such a finding would suggest that famous faces are an exception to the rule of stronger implicit attentional effects for negative than for positive stimuli. This paper describes such a paradigm.

Stone and Valentine (2005) used a modified version of the dot-probe paradigm (e.g., MacLeod, Mathews, & Tata, 1986) to investigate attention towards famous faces presented so briefly that participants could not achieve awareness of the identity of the stimuli. A famous face and an unfamiliar face were presented simultaneously, one each in left and right visual fields, very briefly, with forward and backward masking. Following these stimuli a dot-probe was presented in either left or right visual field and participants were asked to discriminate the type of dot-probe. Responses were more accurate in the visual field previously occupied by the famous face as long as the famous person was evaluated by participants as either "good" or neutral. This was in line with the prediction and suggested that attention had been oriented towards the familiar face, consistent with the supposition that familiar faces were more salient than unfamiliar faces. The surprising result was that responses were more accurate in the opposite field to the famous face when it belonged to a person evaluated as "evil," suggesting that attention had been oriented away from the famous face. If this were a replicable phenomenon then famous faces may constitute a class of stimuli which are exceptions to the rule that potentially threatening stimuli have particular power to attract attention.

A *post hoc* analysis of the previous study suggested that orientation of attention away from "evil" faces was associated with high ratings of disgust, explained as similar to distaste or disapproval, invoked by the famous persons. The emotion of disgust serves to protect against psychological contamination by a noxious idea or person and it motivates avoidance of the object of disgust and turning of attention elsewhere. For example, Plutchik (1980) explained that the emotion of disgust motivates the rejection of the object of disgust, which is

manifest in either a physical moving away or in avoidance of the sensory processing of the object. Similarly, Rozin, Haidt, and McCauley (1999, pp.429-445) proposed that disgust is experienced as a strong desire to withdraw from the eliciting stimulus. Experimental evidence to support this conception of disgust was offered by, for example, Newhagen (1998) who reported that participants moved a paddle away from a screen when they viewed a television news item that had been edited to invoke feelings of disgust, but moved the paddle towards the screen when they viewed the same news item edited to invoke feelings of anger. Leshner, Vultee, Bolls, and Moore (2010) reported that the presence of disgust-related images in an anti-tobacco smoking TV advert could lead to reduced cognitive processing of the message and to worse recognition memory (depending on the level of fear also invoked), suggesting attentional avoidance. Armstrong, Olatunji, Sarawgi, and Simmons (2010) observed that participants low in fear of contamination spent less time looking at a photograph of a face displaying a disgusted expression than at a photograph of the same face displaying a happy expression (both presented simultaneously with a neutral expression, with the disgusted and happy faces presented on different trials). Of particular relevance, the proposal that disgust motivates the avoidance of persons regarded as morally corrupt (e.g. Izard, 1977, pp.329-354; Rozin, *et al.*, 1999, pp.429-445) clearly offers a plausible explanation for the observed attentional avoidance of the faces of famous persons who invoke high disgust in the observer.

The use of naturally occurring stimuli potentially enhances the ecological validity of the research and suggests that a general mechanism may be operating, one likely to be used in everyday life. This is true as long as the effect is replicable over a broad field of famous faces. A previous study used a set of famous persons including several particularly unpleasant characters (e.g., Adolf Hitler, Myra Hindley, Mike Tyson, and O. J. Simpson, the latter two of these following their recent court appearances accused of violent crimes against women). It is theoretically important to establish whether the attentional avoidance is a response only to a small set of extremely well-known images or is a general response to a more diverse group of celebrities. To explore this issue in the present Exp. 1 faces of a broad range of celebrities were drawn from the categories of pop star (13), politician (6), film star (5), television presenter (from the United Kingdom) (4), royal family (of the United Kingdom) (3), sportsperson (1) and supermodel (1). Subliminal presentation of the faces, denying awareness of facial familiarity and identity, would confirm the involuntary and unintentional nature of this attentional effect.

An interesting question concerns the level at which the attentional effect arises. Consider the model of person recognition proposed by Burton, Bruce, and Johnston (1990) in

which a famous face or name is first recognised by the Face or Name Recognition Unit, which then activates the Person Identity Node (this is a theoretical element of the model that symbolises an individual, known person), and in turn this activates the Semantic Information Units containing information about the person. If the negative valence of the famous person arises from information stored in semantic information units then the person's name should have the same power as the person's face to evoke this information. Alternatively, if the negative valence is connected directly to the person's face, then the attentional response might be invoked by the activation of the face recognition unit. In this case a name might not have the same power to invoke the attentional response as the face. This question can be resolved by examining the attentional effects of the faces and names of the same famous people. Previous studies (e.g., Ellis, Quayle, & Young, 1999) reported that faces appear to have orienting effects not apparent for names of the same persons, which suggests that famous names might not have the same influence on attention as famous faces. On the other hand, Bradley, Mogg, and Lee (1997) and Mogg, Bradley, and Williams (1995) reported a bias towards threat-related words presented subliminally, which suggests that perhaps attentional effects may be apparent for the names of famous people. Investigation of this possibility was the aim of Exp. 2.

It is difficult to distinguish between two possibilities in the dot-probe paradigm: participants orient their attention more quickly towards emotionally meaningful stimuli or it takes longer for participants to withdraw their attention from emotionally meaningful stimuli. Fox, Russo, Bowles, and Dutton (2001) noted that a difference in response time between positive and negative stimuli on cued trials would support the more rapid attraction of attention to negative stimuli, and a difference in response time on uncued trials would support the possibility of differential ease of attentional disengagement. In their study only differential ease of attentional disengagement was observed, as in the study by Koster, Crombez, Verschuere, and de Houwer (2004). However, in contrast, West, *et al.*, (2009) reported evidence for prior attentional capture by faces with a threatening expression. The data of the present experiments must be examined for differences in attentional capture and disengagement between stimuli of positive and negative valence.

Previously, Stone and Valentine (2005) reported an attentional effect of famous faces on accuracy of responses to the dot-probe rather than on response time. This is somewhat unusual as effects are more commonly observed on a measure of speed of response. The likely explanation is that the presentation of the dot-probe on the left or right of the screen and the location of response keys also to the left and right of the keyboard activated a Simon

effect (e.g., Simon & Rudell, 1967) in which the appearance of the dot-probe on left or right automatically primed the corresponding hand to produce the response. In fact, in the present experimental task a decision was required based on the orientation of the dot-probe which mapped to a left or right hand response and the location of the dot-probe had no relation to the correct respond hand. This explanation is supported by the observation that the majority of errors in the study by Stone and Valentine (2005) occurred when the correct response hand was incongruent with the location of the dot-probe. To confirm or refute this explanation, the design of the response keys was changed in the present experiments to use two keys above each other in the centre of the screen, operated by two fingers of the same hand. In this way, the dot-probe appearance in left or right visual field would not prime any particular response key. It was predicted that attentional effects in the present experiments would be apparent on response times and not on errors.

To verify that participants were not consciously aware of the identity of the subliminal faces a separate *awareness check* task was used. This asked participants to detect the famous face in a famous-unfamiliar pair of faces presented under exactly the same conditions as the dot-probe task. Failure to perform with accuracy above chance would confirm that the faces were not consciously perceived. This task has been used in previous studies (e.g. Stone & Valentine, 2004) with the interesting result that faces of positively regarded famous persons were selected with greater accuracy than faces of negatively regarded famous persons even though overall performance was at chance; the faces of negative famous persons were selected less often than chance. This result confirms perception without awareness because avoidance of the faces of negative persons was contrary to the task instruction. The present experiments were predicted to produce a similar result.

In Exp. 1 participants performed the same dot-probe task and awareness check task as has been used in the previous studies by Stone and Valentine (2004; 2005). For comparability with these previous studies, participants were asked to evaluate disgust evoked by each stimulus famous person. The first hypothesis was that attention would be withdrawn from the face of a famous person evaluated as invoking high disgust and directed instead to the opposite visual field containing an unfamiliar face, while attention would be attracted towards the face of a famous person evaluated as invoking moderate or low disgust, and this would hold for a broad range of stimulus celebrities. The second hypothesis was that this effect would be apparent in an analysis of response times but not of errors.

Experiment 1

METHOD

Participants

Participants were 20 normal, healthy first-year undergraduate students at Goldsmiths College, London (16 women, 4 men; ages 18 to 44 years, $M = 23.0$, $SD = 7.2$). All participants had watched television in the United Kingdom for at least 5 years by self-report which was required to maximise likelihood of the knowledge of the famous faces.

Stimuli

Sixty famous persons were selected for the experiment. They were selected in the expectation that each would receive favourable rating and unfavourable rating from roughly equal numbers of people in the general population from which the experimental sample was derived. Informal pilot work had been carried out to select these famous persons from a wider pool of possible candidates. It was essential for the research that the stimuli should invoke contrasting evaluations from different people, a situation that arises naturally for many famous persons who have a set of attributes that will be attractive to some people but not others. It is likely that the evaluation given a target person by a participant should depend on the participant's knowledge of the target person and their attitude towards that knowledge. Thus, Michael Jackson might be evaluated positively by participants who like his music and negatively by those who don't like his music, or who feel that there may be some justification in the civil charges laid against him concerning his relationships with certain young children.

The participants in Exp. 1 were asked to make two evaluations of the emotion evoked by the famous target person: the amount of liking (on a 7-point scale with anchors -3: Strong dislike to 3: Strong liking) and the amount of disgust, also on a 7-point scale (1: Low disgust and 7: High disgust). The emotion of disgust was chosen because it was hypothesized to motivate the participant to turn attention away from the object of disgust to protect against psychological contamination by a noxious person (e.g. Izard, 1977, pp.329-354) and it has been specifically related to the avoidance of persons regarded as morally corrupt (e.g. Izard, 1977, pp.329-354; Rozin, *et al.*, 1999, pp.429-445). The correlation between the mean disgust rating and the mean liking rating for each item was very strong ($r_{58} = -.9$, $p < .01$) in the present study, suggesting that participants viewed these scales as measuring the same concept. The correlation between disgust rating and liking rating was also derived for each individual participant and the mean correlation was $r = .66$ in the present study. Therefore, it seemed unnecessary to use both scales, and only the disgust scale was used in the analyses of the attention orientation data and the awareness check data. A given famous person was defined

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as evoking Low disgust for a participant if that participant gave a rating of 1 to 4, and as evoking High disgust for that participant if the rating was 5 to 7, to distinguish those whose disgust rating was above the central point of the scale from the remainder. This scoring was based on the observation by Stone and Valentine (2005) that there was no difference in attentional orientation between the faces of persons evaluated as good or neutral, only between these and the faces evaluated as evil.

A recent photograph of each famous person was obtained from the internet with a frontal pose and a neutral or near-neutral expression; the photographs were resized to 150 × 200 pixels and presented in 16-grey scale. A face of an unfamiliar person was also obtained from the internet to match each of the famous persons on sex, age, race, pose, and facial expression. The planned analysis within-items rules out the effect of any variation between a famous face and its matched unfamiliar face on irrelevant properties of the face or the particular photograph used, for example attractiveness, emotional expression, or lighting.

The faces were presented for 17 msec. and each was closely forward-masked and backward-masked by a mask created from a collage of parts of unfamiliar faces. This is a sufficiently complex mask to preclude a conscious visual percept that might permit awareness of facial familiarity or identity.

The dot-probe was either two horizontal dots (..) or two vertical dots (:).

Apparatus

The stimuli were presented, and responses recorded, on a personal computer running MEL2 software. The faces were displayed at a screen resolution of 640 × 480 pixels.

Design

There were two tasks, attention orientation and awareness check. In each task the pair of faces, one famous and one unfamiliar, were presented simultaneously with one face each in left and right visual field (counterbalanced). The two faces were approximately 4.5 cm × 6 cm and were presented at a distance of 9 cm apart, subtending a visual angle of approximately 4° from fixation measured from the centre of the photograph (and the entire visual angle was 6.63° comprising 3.32° to left and 3.32° to right of fixation) for participants sitting approximately 1.5 m from the screen. The masks were presented in the same screen position as the faces immediately before and following the presentation of the faces.

There were three factors in the attention orientation task, all within-items: visual field of famous face (left or right); visual field of dot-probe (left or right); and rated disgust elicited by the famous person (low or high) recorded after the attention orientation task and the

awareness check. The dependent variables were speed and accuracy of responses to the dot-probe and the task was to discriminate the orientation of the dot-probe: vertical or horizontal.

There were 480 possible combinations of famous face identity \times famous face visual field \times dot-probe visual field \times dot-probe orientation. This was felt to be too many trials for a participant and so each participant did 240 trials, in two blocks of 120 trials each separated by a short rest break. The stimuli and conditions were counterbalanced as follows. Faces were randomly allocated to four sets of equal sizes, sets A to D. Participants were allocated in rotation into four groups, 1 to 4, so there were five participants in each group. For participants in Groups 1 and 2, the faces in Sets A and B were combined with a horizontal dot-probe in the cued location, and a vertical dot-probe in the uncued location; the faces in Sets C and D had the opposite arrangement. This arrangement was reversed for participants in Groups 3 and 4. For the participants in Groups 1 and 3, the faces in Sets A and C were in block 1 and the faces in Sets B and D were in block 2. This arrangement was reversed for participants in Groups 2 and 3. The sequence of presentation was randomised by the computer programme for each participant within each block.

There were two factors in the awareness check task, both within-items: visual field of famous face (left or right) and rated disgust invoked by the famous person (low or high). The task was to select which visual field contained the famous face and a correct response was scored by choice of the visual field in which the famous face had appeared. The dependent variable was accuracy of response, calculated in four conditions of Low disgust versus High disgust \times left visual field versus right visual field. Each pair of famous-unfamiliar faces was presented twice, once each with the famous face in the left and right visual fields, making a total of 120 trials presented in a single block. The sequence of presentation was randomised by the computer programme for each participant.

Procedure

Participants were run one at a time in an air-conditioned and darkened room with a constant low level of background lighting. Each participant performed the same four tasks: the attention orientation dot-probe task, followed by the awareness check, then the identification of the famous faces, and finally the evaluations of each famous person.

The sequence of trials is illustrated in Fig. 1. The procedure can be summarised as follows: 500 msec. fixation cross in a central screen location; 100 msec. forward masks in left and right visual fields; 17 msec. famous and unfamiliar face in left and right visual fields; 100 msec. backward masks in left and right visual fields; dot-probe in either left or right visual field, displayed for 250 msec.; and then a blank screen until the response was made on the

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keyboard. The response time was calculated from the offset of the dot-probe. If no response was received then after 3000 msec. the programme continued on to the next trial. The backward mask duration of 100 msec. was chosen on the grounds that it had been effective in preventing conscious awareness of the faces in a previous study (Stone & Valentine, 2005) and that there was no difference in the attentional effect between 100 msec. and 500 msec. backward masks in the previous study.

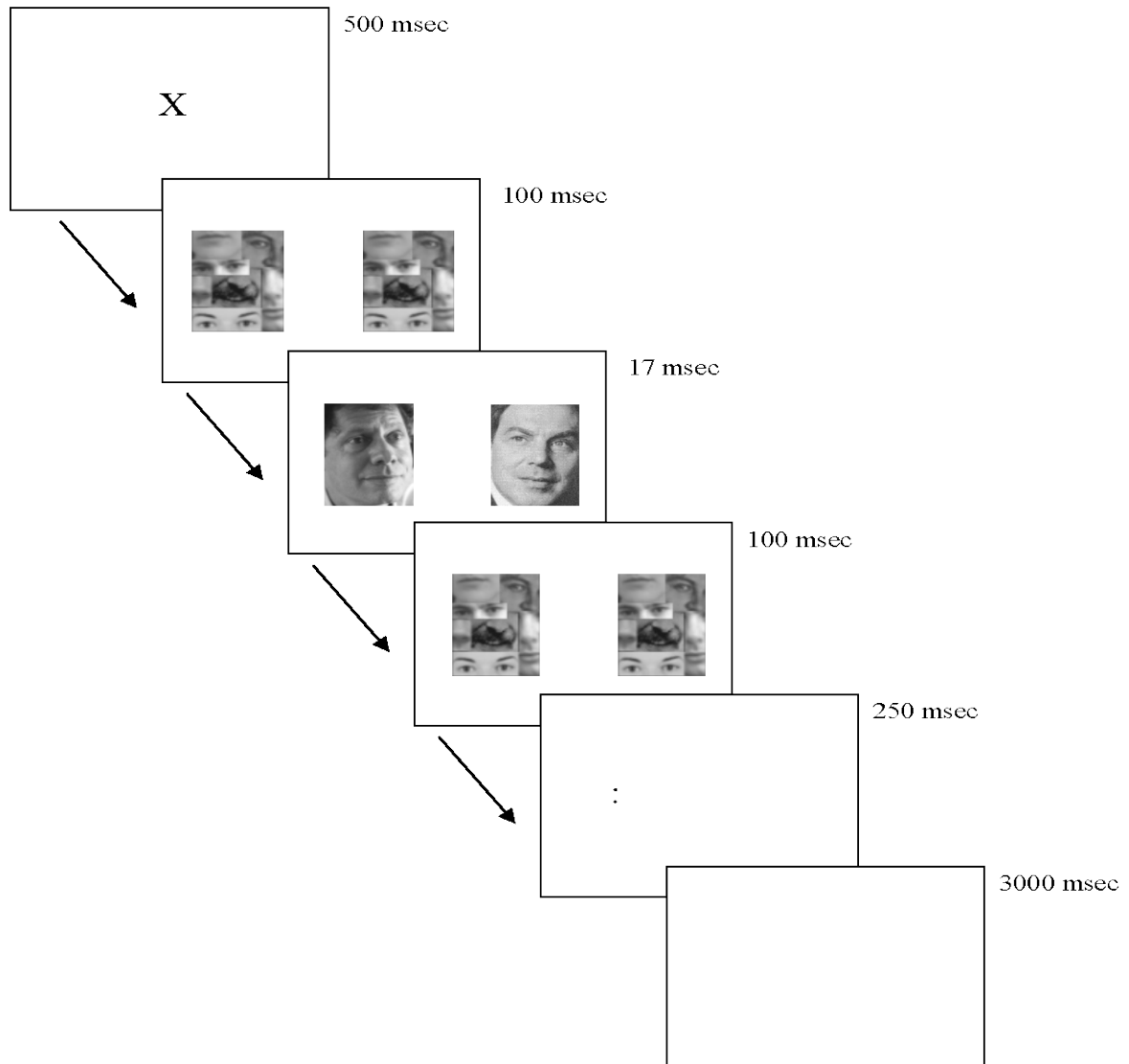


Fig. 1. Illustration of procedure in the attention orientation task, showing the sequence of events and duration of displays.

Participants were asked to discriminate the orientation of the dot-probe and to press the 'h' key if they saw a horizontal dot-probe and the 'v' key if they saw a vertical dot-probe. These keys were chosen because they were positioned one above the other in the centre of the

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keyboard, and participants were asked to use two fingers of the same hand (their preferred hand) to press the 'h' and 'v' keys. This arrangement precluded the possibility of a Simon effect by using the same hand to make all responses; there could be no congruence or incongruence between the visual field containing the dot-probe and the hand used to make the response.

Each participant was allowed as many practice trials as they needed until they were responding accurately and consistently to the dot-probe. The instructions pointed out that before each dot-probe the participant would see a mask displayed in the left and right visual fields. The mask would be very briefly replaced by two faces, one in each visual field, always comprising one famous and one unfamiliar face. These faces would be exposed too briefly for conscious perception, and this was a deliberate part of the design and no cause for concern. Participants were asked to look at the fixation cross in the centre of the screen at the start of each trial, to attend carefully to the screen, and to respond by pressing the 'h' or 'v' as quickly and as accurately as possible after the dot-probe was displayed.

In the awareness check task the stimulus presentation was the same, except that instead of a dot-probe the question "left or right" appeared in the centre of the screen. The participant responded by selecting either the Z key or the M key to indicate left visual field or right visual field as being the field that had briefly contained the famous face. The question remained in the centre of the screen until the participant responded. Each trial began 1 sec. after the response on the previous trial was made.

Eight practice trials were offered to each participant with no feedback about their accuracy. The instructions explained that the stimulus display would be the same as in the previous attention orientation task, i.e., a famous face and an unfamiliar face would be flashed very briefly, one each in left and right visual field. The task was to select which visual field had contained the famous face. Participants were instructed not to be concerned if they could not see the faces clearly, but to look at the fixation cross and try to respond as quickly as possible, guessing if necessary.

After both computer tasks were finished, the participants were asked if they had recognised any of the faces, however vague and lacking in confidence their recognition might have been. Then participants were shown the famous faces one at a time, in a randomised sequence, and asked to identify each person either by name or by providing sufficient biographical information to be able to uniquely identify the famous person. The experimenter recorded the participant's response as uniquely and correctly identified, familiar but not

uniquely identified, or unfamiliar. Only the faces to which a unique identification was made were used in the analyses.

Participants were shown the set of 60 faces again, one at a time, in a different random sequence. They evaluated the disgust evoked by each famous person. Disgust was explained as similar to distaste and disapproval and should be evaluated by thinking about the person, not the face, considering knowledge of that person. They were reassured that there were no right or wrong answers and that the researcher was interested in the personal opinion of the participants. They were also asked to give first impressions rather than deliberate for a long time. After the ratings of disgust, the ratings of liking were collected via a similar procedure. The ratings of liking were not used in this study as they closely resembled the ratings of disgust and therefore contributed largely redundant information.

Finally participants were debriefed and thanked for their participation.

RESULTS AND DISCUSSION

The main analysis was the analysis using items as the random factor (also known as the F2 analysis) in which the famous face was predicted to attract the attention of a participant if they regarded the famous person with low disgust, but to repel the attention of a participant if they regarded the famous person with high disgust. This analysis permits the results to be generalised to the population of famous people from which the stimulus materials were sampled. The attentional effect of each stimulus was calculated by comparing the speed of response to a dot-probe in the cued location (i.e. the visual field containing the famous face) with the speed of response to a dot-probe in the uncued location (i.e. the visual field containing the unfamiliar face), separately for the subsets of participants falling into the Low disgust and High disgust groups. Faster responses in the cued location would indicate that attention was directed towards the famous face.

The participants whose responses were classified into the Low and the High disgust conditions varied from one target to the next. Thus, for example, if a famous person was evaluated as Low disgust by 14 participants and as High disgust by 6 participants, then 14 participants' data would be used to calculate the attentional effect in the Low disgust condition, and 6 participants' data would be used to calculate the attentional effect in the High disgust condition. These numbers would differ for a different target.

The mean rating of disgust for the Low disgust faces was 2.0 ($SD = 1.1$) and the mean rating of disgust of the High disgust faces was 6.1 ($SD = 1.4$). It was considered desirable to ensure an approximate balance in the number of participants evaluating each famous person

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as evoking High and Low disgust, so faces were included in the analysis only when between 15 and 85% of participants evaluated the person as evoking Low or High disgust. Thirty-three items remained in the analysis and 27 items were omitted; the names are listed in Appendix A. The mean proportion of participants rating each face as eliciting High disgust was 32%.

All trials for a particular famous face for a given participant were excluded if either the face was not correctly identified in the post-experimental identification procedure (11.6%), or the face was consciously recognised during the experimental tasks (0.8%). Hence 12.4% of trials were excluded from analysis.

Awareness Check

The mean proportion of correct responses to famous faces was numerically below chance (see Table 1) which permits the conclusion that facial familiarity was not consciously detected, and so there was no awareness of facial identity on the assumption that familiarity must be detected before identity. No individual participant performed above chance in the awareness check.

In line with prediction, the proportion of accurate responses was higher when the famous faces evoked Low disgust than when they evoked High disgust in a paired-samples t test (see Table 1). In a one-sample t test, the accuracy of responses to Low disgust faces was at chance but the accuracy of responses to High disgust faces was below chance (see Table 1).

An analysis with participants as the random variable (an F1 analysis) showed similar results¹. The small number of male participants did not permit an analysis broken down by sex.

¹ The proportion of accurate responses was higher when the famous faces evoked Low disgust than when they evoked High disgust ($t_p(19) = 2.31, p < .05$, two-tailed). Low disgust $M = 0.51, SD = 0.04$; High disgust $M = 0.46, SD = 0.08$.

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Table 1. Awareness Check Task. Mean and SD of the proportion of correct responses to famous faces or names in conditions of Low disgust or High disgust, or Liking or Dislike; ^Acomparisons against chance level of 0.5; ^Bcomparisons of Low versus High disgust or Liked versus Disliked; effect sizes calculated as Cohen's *d*; and 95% confidence intervals.

Valence	Mean (SD)	<i>t</i> test comparison	Cohen's <i>d</i>	95% CI
<i>Exp.1 Faces</i>				
Low disgust	0.50 (0.12)	^A One-sample $t_i(32) = 0.08$, ns	0.01	-0.04, 0.04
High disgust	0.44 (0.11)	^A One-sample $t_i(32) = 2.83$, $p < .01$	0.51	-0.10, -0.02
Total	0.47 (0.09)	^A One-sample $t_i(32) = 1.71$, ns	0.31	-0.06, 0.01
Low versus High Disgust		^B Paired $t_i(32) = 2.08$, $p < .05$	0.36	0.00, 0.12
<i>Exp.2 Faces</i>				
Liked	0.50 (0.04)	^A One-sample $t_i(9) = 0.12$, ns	0.04	-0.03, 0.03
Disliked	0.47 (0.03)	^A One-sample $t_i(9) = 2.73$, $p < .05$	0.86	-0.05, -0.01
Total	0.49 (0.03)	One-sample $t_i(9) = 1.35$, ns	0.43	-0.04, 0.01
Liked versus Disliked		^B Paired $t_i(9) = 3.51$, $p < .005$	1.11	-0.05, -0.01
<i>Exp.2 Names</i>				
Liked	0.51 (0.05)	^A One-sample $t_i(9) = 0.73$, ns	0.24	-0.02, 0.04
Disliked	0.52 (0.06)	^A One-sample $t_i(9) = 1.14$, ns	0.35	-0.02, 0.06
Total	0.51 (0.05)	One-sample $t_i(9) = 0.90$, ns	0.28	-0.02, 0.05
Liked versus Disliked		^B Paired $t_i(32) = 0.83$, ns	0.26	-0.02, 0.04

Attention Orientation

For the analysis of response times, trials were excluded if the response to the dot-probe was incorrect (7.4% of trials) or if the response time was faster than 200 msec. (probable anticipations; none). Trials on which responses were slower than 3 sec. were excluded (0.6% of trials). There were no differences in attention orientation between famous faces presented in the left visual field and the right visual field ($F < 1.2$ for the main effect of visual field and for all interactions involving the factor of visual field) and therefore the two factors of famous face visual field and dot-probe visual field were collapsed into a single factor termed cued versus uncued location of the dot-probe.

Analysis of variance was performed with two within-item factors of disgust evoked by the famous person (High versus Low) and location (cued versus uncued) using response times as the dependent variable. There was no main effect of disgust or of location (Table 2). There was a significant interaction of disgust with location, and planned paired-samples t tests were performed to investigate the interaction. These revealed that responses following high disgust evoking faces were faster in the uncued than in the cued location, while responses following Low disgust evoking faces tended to be faster in the cued location (Table 2). This implies that attention was oriented away from High disgust-evoking faces and tended to be oriented towards Low disgust-evoking faces. See Fig. 2 for an illustration of the interaction between disgust and location. Analysis with participants as the random variable (F1 analysis) showed a similar pattern of results².

A separate analysis of variance was performed with errors as the dependent variable and two factors of disgust (Low versus High) and location (cued versus uncued). There were no statistically significant effects ($F < 1$ for the main effect of disgust, the main effect of location, and their interaction).

Attentional orientation effects were as predicted: attention was oriented away from famous faces by those participants in whom the famous person evoked High disgust, and there was a tendency to orient towards the famous faces by those participants in whom the famous person evoked Low disgust. This demonstrates the attentional avoidance of a wide range of celebrities, not generally known for their violent or criminal acts. Thus, the attentional avoidance of these negative stimuli appears to be a general effect of the category of famous faces. Possible reasons for the observation of this effect, contrary to the more commonly observed effect of attentional capture by negative stimuli, will be considered in the General Discussion.

The attentional effects were apparent in the analysis of response times but not that of errors. This suggests that the use of two response keys in the centre of the keyboard, one above the other, operated by two fingers of the same hand, had been effective in precluding the operation of a Simon effect. The observation of attentional effects on response times rather than on errors is more consistent with the literature on the dot-probe paradigm.

² There was a significant interaction of disgust level with location [$F_p(1,19) = 11.5, p < .005$]. Paired-samples t tests showed that responses following High disgust-evoking faces were 45 msec. faster in the uncued than in the cued location [$t_p(19) = 3.18, p < .05$], while responses following Low disgust-evoking faces were 27 msec. faster in the cued location [$t_p(19) = 2.11, p < .05$].

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Table 2. Attentional orientation task. The top panel shows mean and standard deviation of response times (msec.) to dot-probes following faces or names in conditions of Low or High disgust, or Like or Dislike in the cued and uncued location; the orientation effect (response time in the uncued minus the cued location); comparison of orientation in a paired-sample *t* test; effect size of orientation effect; 95% confidence interval of orientation effect. The bottom panel shows the results of analyses of variance.

Valence	Cued Mean (SD)	Uncued Mean (SD)	Orient-ation	<i>t</i> -test (paired-samples)	Cohen's <i>d</i>	95% CI of Orientation effect
<i>Exp.1 Faces</i>						
Low disgust	394 (57)	417 (74)	23	$t_i(32) = 1.50, ns$	0.35	-8, 55
High disgust	425 (74)	380 (48)	-44	$t_i(32) = 2.67, p < .05$	0.72	-78, -10
<i>Exp.2 Faces</i>						
Liked	465 (28)	475 (32)	10	$t_i(9) = 1.23, ns$	0.33	-8, 27
Disliked	489 (33)	468 (28)	-20	$t_i(9) = 2.34, p < .05$	0.66	-40, -10
<i>Exp.2 Names</i>						
Liked	481 (22)	478 (30)	-3	$t_i(9) = 0.5, ns$	0.12	-16, 10
Disliked	473 (24)	476 (27)	3	$t_i(9) = 0.5, ns$	0.12	-9, 14

Analyses of variance	Main effect			Interaction
	Valence	Location	Stimulus type	
<i>Exp. 1 Faces</i>	$F < 1$	$F < 1$	n/a	$F_i(1,32) = 9.71, p < .005, \eta^2 = 0.23$
<i>Exp. 2 Faces and names</i>	$F < 1$	$F < 1$	$F < 2.6, ns$	$F_i(1,9) = 8.63, p < .02, \eta^2 = 0.49$
<i>Exp. 2 Faces</i>	$F < 1$	$F < 1$	n/a	$F_i(1,9) = 8.99, p < .02, \eta^2 = 0.50$
<i>Exp. 2 Names</i>	$F < 1$	$F < 1$	n/a	$F_i(1,9) < 1.1, ns$

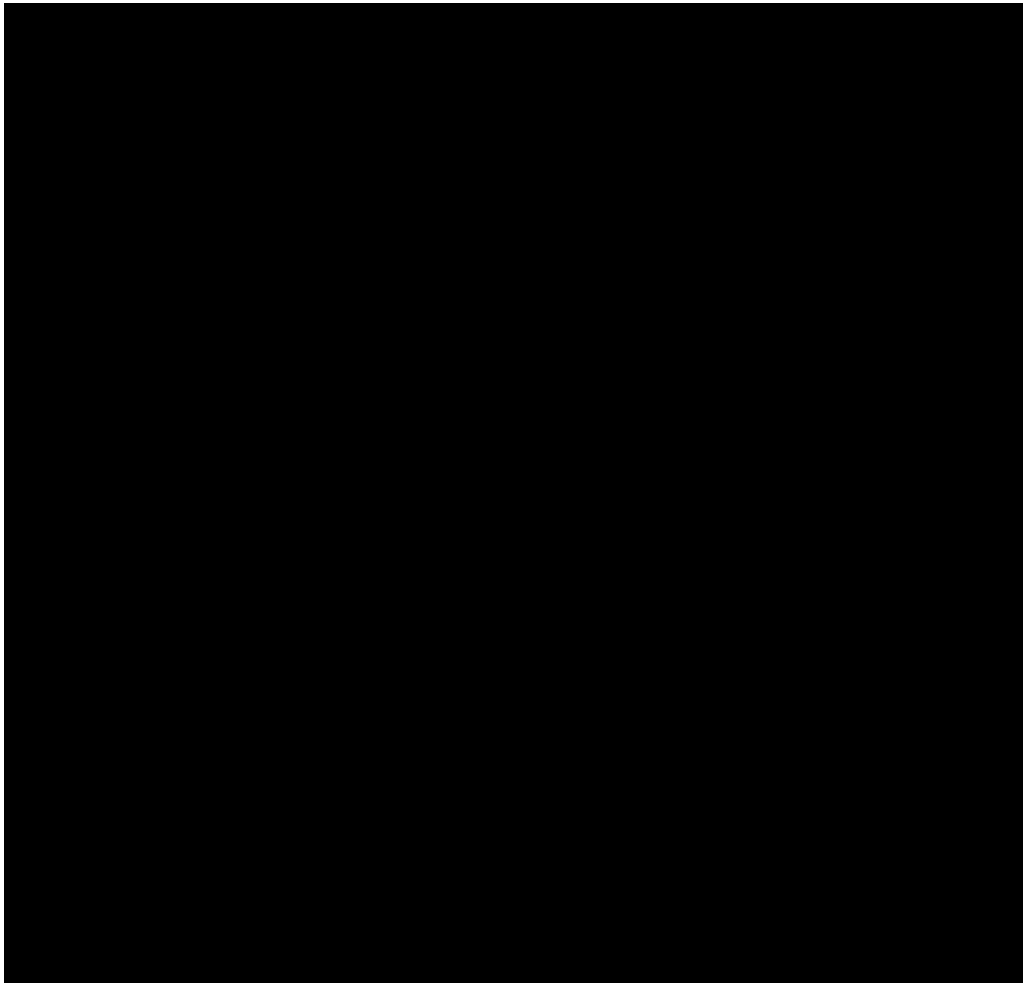


Fig. 2. Experiment 1: mean response time to dot-probes following faces evoking Low disgust (white circles) and High disgust (black circles), in the cued and uncued locations. Bars represent 95% confidence intervals.

Experiment 2

The attentional avoidance of the faces of famous persons having negative evaluations, described in Exp. 1, raises the question of the origin of this effect: whether it stems from the stored semantics relating to the individual person or is triggered by perception of the face. A natural way of investigating this question is to use the names and the faces of the famous persons. Observing equivalent attentional effects would allow the inference that attentional avoidance arose from stored semantic information activated by the perception of either face or name. Finding attentional effects only for faces would indicate the face as the source of the effect.

METHOD

For brevity of exposition only the differences from Exp. 1 will be described. Unless otherwise stated all aspects of the Method were similar to Exp. 1.

Participants

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Participants were 35 normal, healthy students at the University of East London, and thus represent a similar sample to that of Exp. 1, being drawn from a neighbouring location of the same city. Data were excluded from one participant with unusually slow responses and from six participants who performed above chance in the awareness check, leaving 21 women and 7 men (ages 18 to 47 years, $M = 25.2$, $SD = 8.1$). All participants had adequate familiarity with the famous persons used as stimuli, and all gave at least two of the famous people a positive evaluation and two of them a negative evaluation.

Stimuli

Stimuli were the faces and names of 10 famous people listed in Appendix A. The parameters for the presentation of the faces were the same as those in Experiment 1. The names were presented in Ariel 11-point font in white on a black background, occupying the same screen positions as the faces. The mask for the names was a sequence of random letters. Non-famous names were realistic names of the same length and the same number of syllables as the famous names. The names were presented for 33 msec. compared to 17 msec. for the faces, following informal piloting confirming that there was no conscious recognition of the names at 33-msec. exposure. The slightly longer exposure for names was chosen to maximise the chance of participants being able to recognise the names as long as the important criterion was met that there should be no conscious awareness of the names.

Design

Six tasks were completed by each participant: the face and name dot-probe tasks, the face and name awareness check tasks, and the identification and then the evaluation of the famous persons. The design of the dot-probe task and the awareness check task were both similar to those of Experiment 1, the major difference being the reduction in the number of stimuli. In the dot-probe tasks there were eight combinations of visual field of famous face or name, visual field of dot-probe, and type of dot-probe; each was presented twice for each famous face or name making a total of 160 trials for each task. In the awareness check tasks there were 120 trials, with each famous person's face or name shown six times in each visual field.

Procedure

The major difference was the inclusion of two extra tasks, dot-probe and awareness check, for the name stimuli. The two dot-probe tasks were always completed first, in a counterbalanced sequence, and the two awareness check tasks were always performed after the two dot-probe tasks, also in a counter-balanced sequence.

The evaluation terms were changed from “disgust evoked by the famous person” to a simple Like/Dislike forced choice. This was a more natural terminology and a more familiar decision for the participants. The change in the evaluation scale was justified by the observation that in Exp. 1 there were strong correlations between the disgust scores and the liking scores.

RESULTS AND DISCUSSION

All trials for a particular famous face for a participant were excluded if either the face was not correctly identified in the post-experimental identification procedure (6.2%) or the face was consciously recognised during the experimental tasks (none). All trials for the equivalent famous names were also excluded.

Awareness Check

In the F2 analysis with items as the random factor, the mean proportion of correct responses to famous faces was not significantly above chance in a one-sample *t* test (Table 1). This permits the conclusion that facial familiarity was not consciously detected, and by assumption, there was no awareness of facial identity. Contrary to prediction, there was no difference in the accuracy of responses to Liked and Disliked faces (Table 1).

The mean proportion of correct responses to famous names was not above chance permitting the conclusion that name familiarity and identity were not consciously detected. As predicted, responses were more accurate to the names of Liked famous persons than to the names of Disliked persons (Table 1). In the F1 analysis with participants as the random variable the same result was obtained: responses were more accurate to names of Liked than Disliked faces³. The small number of male participants did not permit an analysis broken down by sex.

This verifies that some name recognition did occur, without awareness, since the disliked names were selected below chance, contrary to the task instruction. There is no explanation for the failure to observe the predicted effect in the responses to the famous faces, other than to note that even a reliable effect may sometimes not be replicated.

Attention Orientation

Trials were excluded if the response to the dot-probe was incorrect (2.4 / 2.5% of trials in the face or name task, respectively) or if the response time was faster than 200 msec. (probable anticipations; 0.1 / 0.2% of trials) or slower than 3 sec. (0.1 / 0.1% of trials). There

³ In a paired-samples *t* test ($t_{27} = 1.94$, $p < .05$, one-tailed for a directional hypothesis).

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were no significant main effects or interactions involving the factor of visual field (left or right) and so the two factors of famous face or name visual field and dot-probe visual field were collapsed into a single factor of cued versus uncued location.

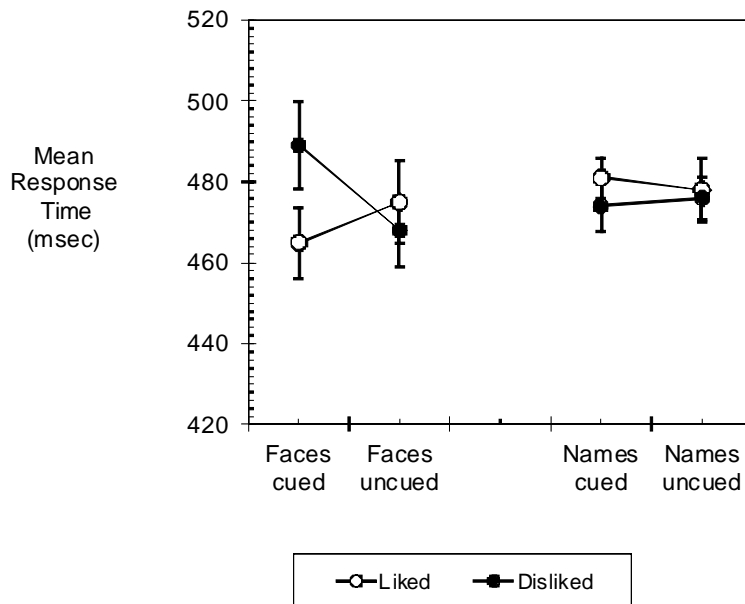


Fig. 3. Experiment 2: mean response time to dot-probes following faces and names of Liked famous persons (white circles) and Disliked famous persons (black circles), in the cued and uncued locations. Bars represent 95% confidence intervals.

Analysis of variance was performed with three within-item factors of stimulus type (name versus face), liking (Liked versus Disliked) and dot-probe location (cued versus uncued) with response time as the dependent variable. None of the main effects of stimulus type, liking, or dot-probe location were significant (Table 2). The three-way interaction was significant, indicating that faces and names had different effects on attention.

A separate analysis of variance was performed for each type of stimulus (Table 2). For the face stimuli there was a significant interaction of liking with location. Planned paired-sample *t* tests were conducted to explore the interaction, and these showed that responses following Disliked faces were faster in the uncued location than in the cued location, indicating orientation away from Disliked faces. There was a non-significant tendency for

responses following liked faces to be faster in the cued location than in the uncued location. (Fig. 3). For the name stimuli there were no significant main effects, and no significant interaction of liking with location (see Table 2).

The F1 analysis with participants as the random factor yielded a similar pattern of results⁴. As in Exp. 1, attention was oriented away from famous faces by those participants who Disliked the famous person, and there was a tendency to orient towards the famous faces by those participants who Liked the famous person. There was no equivalent orientation effect for famous names and the attentional effect of the famous names was not in the same direction as the famous faces (Table 2 and Fig. 3). The observation that participants' attention was not influenced by the famous names cannot simply be attributed to a failure to recognise (without awareness) the names, since the analysis showed the predicted effect in the awareness check task, that is, higher accuracy of responding to Liked names than to Disliked names. This shows that participants had extracted sufficient information from the names to enable responses meaningfully related to their attitudes. Stimulus presentation conditions were identical in the dot-probe and awareness check tasks so a stimulus recognisable in one task was expected to have been recognisable in the other.

It is possible that the awareness check is more sensitive than the dot-probe task to weak recognition so famous names had an effect in the awareness check but not in the dot-probe task. However, this explanation is not consistent with the observation that famous faces had their effect on the dot-probe task but not on the awareness check. If the latter is a more sensitive task then the opposite pattern would have been predicted. A similar type of explanation might say that attention was temporally focused on the dot-probe rather than on the famous face / name stimuli, but again, this does not explain why the famous faces had an attentional effect in the dot-probe task. At the least, these results suggest that faces have an effect on attentional orientation more powerful than the names of the same famous persons under certain experimental conditions.

The duration of exposure for faces was the same in Exp. 1 and Exp. 2 (17 msec.), and was longer for names in Exp. 2 (33 msec.). Looking only at the awareness check results, this might suggest that participants in Exp. 2 were simply less able to obtain information at 17 msec., but could extract information at 33 msec., and hence showed an effect for names but no effect for faces. However, this would not explain why there was an attentional orientation effect for faces in Exp. 2 that was similar to the effect in Exp. 1. Hence, the difference in

⁴ There was a significant three-way interaction of stimulus type with liking and dot-probe location, $F_1(1,27) = 5.28, p < .05$. For the face stimuli there was a significant interaction of liking with location, $F_1(1,27) = 5.15, p < .05$. For the name stimuli the interaction of liking with location failed to reach significance, $F < 1$.

awareness check results of Exp. 1 and Exp. 2 (and between faces and names in Exp. 2) does not seem likely to have arisen from the duration of exposure.

GENERAL DISCUSSION

Exp. 1 showed orientation of attention away from the faces of famous persons who evoked Dislike or High disgust, and a tendency to orient towards the faces of persons evoking Liking or Low disgust, in comparison with an unfamiliar face. Exp. 2 showed similar attentional effects for Disliked and Liked famous faces but no influence on attention of famous names belonging to the same persons. This occurred without conscious recognition of the faces, as shown by performance at chance level on the awareness check task of both experiments.

It should be noted that the orientation away from the face of a famous person invoking Dislike or Disgust co-occurred with orientation towards the face of the unknown person presented simultaneously in the opposite visual field. Hence, the attentional effect of the famous face was a result of a competition with the unfamiliar face rather than occurring in isolation.

Results of the awareness check showed that the famous names could evoke a predictable emotional response: the famous name was more accurately detected by participants who evaluated the famous person as Liked than as Disliked (Exp. 2). At the same time, the analysis of responses to this task shows that the names were not consciously recognisable because the names of Disliked persons were selected with accuracy less than chance, contrary to the task instruction. Thus, it appears that famous names were recognisable (without awareness) under the particular conditions of Exp. 2 but had no effect on spatial attention. Thus, it can be concluded that famous faces have some stronger effects on attention than faces of the same persons under conditions of non-awareness.

The failure of famous names to invoke attentional orientation is consistent with work of Ellis, *et al.* (1999) who found no differential skin conductance response for famous and unfamiliar names, although higher skin conductance response was observed to famous faces than to unfamiliar ones. The skin conductance response has previously been associated with an attentional orienting response triggered by the appearance of a familiar stimulus (e.g. Bauer, 1984; Bauer & Verfaellie, 1988) so it appears that faces have a stronger attentional effect than names of the same persons. This could reflect the stronger “presence” of the face; faces indicate the persons whereas the name is a mere arbitrary symbol. The absence of any attentional effect of famous names is also similar to the finding of Bindemann, *et al.* (2005)

that famous faces retained more attention than names of the same persons. Also consider the de Houwer and Hermans finding (1994) that pictures, relative to words, have privileged access to a semantic network of affective information. In terms of the Burton, *et al.* model (1990) of person recognition, the attentional orienting response seems to arise at the Face Recognition Unit rather than the Semantic Information Unit. In other words, the affective response to a face is triggered directly by the perception of the face and does not require the retrieval of information from long term semantic memory. The affective response to a name appears weaker than the response to a face.

The magnitude of the response time difference between positive and negative faces was similar in the cued and the uncued location. Considering the logic of Fox, *et al.* (2001) this finding suggests that the attentional effects were equally apparent on the capture and disengage components of attention. The observation of a difference between positive and negative faces in the cued location suggests that positive faces capture attention more readily than negative faces. The observation of a difference in the uncued location suggests that it is easier to disengage attention from faces evoking negative reactions than from those evoking positive reactions.

Orientation away from the faces of famous persons who are disliked or who evoke disgust is an interesting result. Previous studies using facial stimuli have tended to reported attentional bias to negative emotion; for example, Mogg and Bradley (1999) found that attention was attracted more strongly to fearful faces than to happy faces, and similar results were reported by Fox, Russo, and Dutton (2002) and by Eastwood, Smilek, and Merikle (2003)—see Robinson (1998) for a review. One key difference is that previous studies have tended to use faces depicting angry or fearful emotional expressions as their negative stimuli. These emotional expressions pose a threat to the perceiver and thereby generate relatively strong attentional effects. The phenomenon of orientation away from a disgust-evoking famous face can be understood by considering that a disgust-evoking stimulus or a person who is disliked does not pose a threat of attack which might require an active response, rather passive non-interaction is sufficient to avoid a negative outcome. Consequently, there is no activation of the autonomic nervous system (e.g. Ekman, Levenson, & Friesen, 1983; Levenson, Ekman, & Friesen, 1990) and no attentional orientation towards the stimulus. Instead, passive non-interaction with a disliked or disgust-evoking person is achieved by withdrawing attention from the stimulus.

A slightly different explanation is suggested by the study by Mansell, Clark, Ehlers, and Chen (1999), who reported a specific and constrained example of attentional orientation

away from facial stimuli. In their study, socially anxious participants avoided emotional faces in an attempt to prevent eye contact and preclude an interaction with the depicted persons. The results of the present study may be interpretable in a similar way. Orientation of attention away from the faces of famous persons invoking high disgust can be understood as a means of reducing the possibility of a social interaction with these undesirable interaction partners.

Thus, there are two different kinds of interpretation of attentional orientation away from the faces of famous persons evoking high Disgust in these experiments. The general interpretation is that any disgust-evoking stimulus motivates the displacement of attention to an alternative object or event. The specific interpretation is that turning away from the face avoids eye contact, thereby reducing the possibility of a social interaction with an undesirable partner. A study using non-face objects could compare these two interpretations. A similar dependence of attention orientation on evoked disgust would support the general explanation, while a weaker effect would tend to support the specific eye contact interpretation.

Is it also interesting to note that these effects were observed in normal, healthy students not selected for high scores on trait anxiety. The implication is that the attentional avoidance of the faces of famous persons who evoke negative evaluations may be a general feature of human cognition.

The present experiment has an implication for interpretations placed on pre-conscious recognition of facial expressions. It is sometimes suggested that this ability is innate or alternatively is learned early in life when neural plasticity is strong. A similar argument cannot be applied to pre-conscious recognition of the facial identities of persons who have only recently become famous and whose faces have consequently only recently been learned. Some of the famous persons used in the present study become widely known only relatively recently. Pre-conscious recognition of facial identity implies that sophisticated processing can proceed without awareness, up to the stage at which identity is detected and the affective response is initiated. It also appears that this occurred with sufficient speed to influence the spatial orientation of attention within a 100-msec. stimulus onset asynchrony.

In conclusion, it appears that attention is elicited or not by famous faces recognised without awareness, depending on the affect associated with the famous persons. Famous names did not show a similar relation to spatial attentional orientation.

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Appendix A: Target Faces

Experiment 1

Pop stars: Victoria Beckham, Cher, Eminem, Liam Gallagher, Geri Halliwell, Michael Jackson, Mick Jagger, Elton John, Jennifer Lopez, Madonna, George Michael, Britney Spears, Robbie Williams

Royal family: Prince Charles, Queen Elizabeth, Sarah Ferguson

Politicians: Tony Blair, George W. Bush, Bill Clinton, William Hague, John Major, Margaret Thatcher

TV presenters: Michael Barrymore, Chris Evans, Anne Robinson, Chris Tarrant

Film/TV actors: Russell Crowe, Leonardo Dicaprio, Michael Douglas, Callista Flockhart, Arnold Schwarzenegger

Others: David Beckham (sports), Naomi Campbell (model)

Experiment 2

Paris Hilton, Michael Jackson, Prince Charles, Britney Spears, Gordon Ramsey, Victoria Beckham, Jordan, Jennifer Lopez, Kate Moss, Tony Blair.