

Influence of gaze direction on face recognition: A sensitive effect

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Running head: gaze direction and face recognition

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Abstract

This study was aimed at determining the conditions in which eye-contact may improve recognition memory for faces. Different stimuli and procedures were tested in four experiments. The effect of gaze direction on memory was found when a simple “yes-no” recognition task was used but not when the recognition task was more complex (e.g. including “Remember-Know” judgements, cf. Experiment 2, or confidence ratings, cf. Experiment 4). Moreover, even when a “yes-no” recognition paradigm was used, the effect occurred with one series of stimuli (cf. Experiment 1) but not with another one (cf. Experiment 3). The difficulty to produce the positive effect of gaze direction on memory is discussed.

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Introduction

Several recent studies have shown that manipulating the gaze direction of face stimuli could influence their later recognition (Daury, 2009; Hood, Macrae, Cole-Davies, & Dias, 2003; Mason, Hood, & Macrae, 2004; Smith, Hood, & Hector, 2006; Vuilleumier, George, Lister, Armony, & Driver, 2005). Authors have reported that faces seen with a direct gaze (i.e. the gaze directed to the observer) are more likely to be recognized at a subsequent recognition task compared to faces seen with a laterally deviated gaze. In the Mason et al. (2004) study, participants were presented with frontal views of faces displaying either direct or deviated gaze and were asked to perform an age classification task (does a person look above or under 21?), or a spatial detection task (is the face situated on the right or left of a fixation cross?). In a surprise recognition task, the participants' performance was better for targets presented with a direct gaze during the initial classification task. The same influence of gaze direction on memory for faces was reported by Hood et al. (2003) with a forced-choice recognition of frontal views of faces presented either with a direct or a deviated gaze at the encoding where the participants were simply asked to look at the faces. Moreover, Vuilleumier et al. (2005), using a sex judgement task at the encoding phase, showed an effect of direct gaze on recognition memory when the head was seen in a three-quarters profile. However, they did not report the effect with faces presented in a frontal view. It has been suggested that this recognition advantage for faces with eyes directed at the self would reflect the elaborate encoding operations that are undertaken on such stimuli because of the social importance of this gaze configuration (Mason et al., 2004). A first study has called this memorial effect of direct gaze into question (Daury, 2009). Indeed, using a different kind of recognition task (i.e. "Remember/Know/Guess" paradigm, for a synthesis, see Gardiner & Richardson-Klavehn, 2000), the quantitative effect of direct gaze on correct recognition rates (calculated as the sum of the correct "remember", "know" and "guess" responses) was not obtained across three

different experiments. Evaluating whether the state of awareness that accompanied recognition was different for faces with direct and with deviated gaze, the aim of that study was to test the previously suggested hypothesis that faces displaying direct gaze are more likely to elicit deep processing. Indeed, deeper processing is known to enhance Remember responses (referring to a subjective state in which we recreate previous events and experiences with the awareness of reliving these events and experiences mentally) without influencing the rates of Know responses (referring to experiences of the past that include a sense of familiarity towards an event without reliving it mentally) in a face recognition task (Konstantinou & Gardiner, 2005).

Nevertheless, this study (Daury, 2009) had brought some evidence that, as Mason et al. (2004) have claimed, “If someone is looking in your direction, you are likely to remember them”. When the task during the encoding phase involved intentional learning, the rate of “Remember” responses was significantly higher for faces presented with direct gaze than for faces displaying deviated gaze. This finding supported, in some sense, the general idea that eye contact influences person memory. However, this last study does not match the idea that eye contact increases face recognition in an episodic memory task in terms of global recognition performance (hits). Some factors may have contributed to the non replication of this quantitative effect on hit rates. The fact that different sets of stimuli were used across studies could explain, at least in part, the discrepancy. First, the angle of deviation of the eyes from the straight gaze was smaller in that study (22.5°; Daury, 2009) than in the Vuilleumier et al.’s study (30°) and both in the Hood et al. (2003) and the Mason et al. (2004) studies (about 60°; Hood (2007), personal communication). Second, Daury’s (2009) presented faces were those of young people aged between 18 and 30. By contrast, Vuilleumier et al.’s stimuli included young faces as well as faces of middle aged and elderly persons. In addition, Daury’s (2009) stimuli did not contain people bearing hair or artefactual details on their faces, which

involves non-facial information processing. Many faces in the Vuilleumier et al.'s (2005) set of stimuli wore bears, glasses, side whiskers, etc. Moreover, top of clothes were visible. All these details were likely to make Vuilleumier et al.'s (2005) stimuli much more distinctive than Daury's (2009).

In order to understand further the discrepancies between the results found in the literature, the present study was aimed at determining which factors influence the occurrence of the direct gaze effect. In a first experiment we used a set of stimuli and a recognition task that have provided positive results in previous experiments. So the Vuilleumier et al.'s (2005) stimuli (profile view) were employed with a simple "yes-no" recognition paradigm. If we obtain an effect of gaze direction on performance in experiment 1, then we should determine whether the previous non replication was linked to the stimuli or to the recognition task used, or even both. In order to disentangle the respective role of stimuli and recognition task, two others experiments were carried out. In Experiment 2, the same stimuli as Experiment 1 were presented but the "Remember/Know/Guess" paradigm was used. Furthermore, this experiment should answer the initial question of Daury's (2009) paper: if the state of awareness differs for stimuli directed to the observer and stimuli gazing away, and that, as Mason et al. (2004) hypothesized, faces displaying direct gaze are more likely to elicit deep processing, then we expect conscious recollection (i.e. remembering experiences) of such faces to occur more often compared with faces displaying deviated gaze. In the third experiment we used Daury's (2009) set of stimuli with a "yes-no" recognition paradigm. If we obtain an effect of gaze direction on memory performance, we could conclude that the problem was not the stimuli but the recognition task used. In order to test another kind of recognition task including a metacognitive component (as the "Remember/Know/Guess" task

did), a fourth experiment used the Vuilleumier's (2005) stimuli with the "yes-no" paradigm to which a confidence rating was added.

See Table 1 for an outline of the recognition tasks and stimuli used in the following experiments.

INSERT TABLE 1 ABOUT HERE

Experiment 1

Method

Participants

Twenty-four undergraduates (12 women and 12 men) aged between 18 and 27 years (mean age = 21.7) volunteered. They all had normal or corrected-to-normal vision. All participants gave written informed consent.

Stimulus materials and procedure

The stimuli used in the present experiment were those used in Vuilleumier et al. (2005). The experiment comprised a first exposure phase (encoding phase) and a subsequent memory phase (recognition phase). During the encoding phase, 24 different (12 male and 12 female) greyscale faces were presented in a randomized order to the participants. These stimuli were presented on a monitor controlled by a PC computer and were viewed at a distance of 60 cm. The pictures were centred at fixation and measured 15.2 cm high by 11.6 cm wide. All faces were unfamiliar to participants and conveyed a neutral facial expression. All the faces were shown in a profile view (rotated by 30° from the camera half rightwards and half leftwards). Gaze direction (direct or deviated) was counterbalanced across the faces in a stimulus set so that, for any given stimulus, half of the participants made a judgement on the face presented with deviated gaze and half made a judgment on the same face presented with direct gaze. During this encoding phase, participants were asked to classify the faces as male or female as quickly as possible by pressing one of two keys. Each trial began with a fixation cross appearing at the centre of the screen for 500 ms, followed by a face for 2000 ms. The inter-trial interval was 1000 ms.

After the gender classification task participants completed a 2 minute filler task in which they were required to indicate as many names of countries as possible on a blind map of Europe. This was followed by the second phase of the experiment, i.e. a surprise recognition test in which 48 faces (24 targets and 24 lures) were presented on the screen. During this recognition phase, all stimuli were displayed in frontal view in order to ensure that face recognition and not pattern matching was investigated (Bruce, 1982). Half of the targets presented with a direct gaze during encoding phase were presented again with a direct gaze while the other half were presented with a deviated gaze. The same control was applied for faces previously presented with deviated gaze. Half of the lures were presented with direct gaze while the other half were presented with deviated gaze. The status of a face as a target (“old”) or a lure (“new”) was counterbalanced so that any given stimulus was a target for half of the participants and a lure for the other half of the participants. The recognition task was a “yes/no” choice in which participants had to report for each face, whether or not it had been seen in the previous phase, by means of a key press. Each stimulus disappeared after the “yes/no” response was made and the inter-trial interval (1000 ms) started.

Results and discussion

An alpha level of .05 was used for all statistical tests (paired sample *t* tests).

At the encoding phase, error rates were very small (1.6 % on average) and were not submitted to further analysis. Median correct response times for judging the gender of the faces were computed for each participant and each condition. Average median RTs to face displaying direct gaze ($M = 619$ ms, $SD = 112$) and to faces displaying averted gaze ($M = 632$ ms, $SD = 121$) were not significantly different, $t(23) = 1.19$; $p > .10$.

In order to analyse data from the recognition phase, the rates of hits (correct recognitions) were computed for each participant and each condition. The analysis revealed a significant

difference between the direct and the deviated gaze conditions, $t(23) = 2.63$; $p < .05$, with 69.4 % of hits in the direct condition compared to 60.4 % for the faces displaying a deviated gaze during encoding. The false alarm rates were not significantly different between both directions of gaze, $t(23) < 1$.

d' was used as a measure of discrimination, and C as a measure of bias (Brophy, 1986). These measures were calculated for each participant and each condition. The mean d' and C for faces with direct gaze were not significantly different from the mean d' and C for faces with deviated gaze, all $ps > .10$. All descriptive data are presented in Table 2.

INSERT TABLE 2 ABOUT HERE

In conclusion, we obtained a memory advantage for faces displaying direct gaze compared with faces displaying deviated gaze when using the Vuilleumier et al. (2005) stimuli. This result supports the hypothesis that stimuli used in Daury (2009) were not suitable for the direct gaze effect to occur and could explain the divergence found between the results of the Daury (2009) study and those of previous studies.

In the next experiment, in order to test the prediction that the state of awareness accompanying the memory of the face differs between the two different directions of gaze (direct and deviated), the same stimuli as in Experiment 1 (i.e., Vuilleumier et al's, 2005) were used and the “Remember/Know/Guess” paradigm was added to the recognition task. If stimuli used in Daury (2009) were actually the cause of the absence of direct gaze effect, the next experiment, is expected to show higher hit rates for faces presented with direct gaze, as it was observed in the first experiment of the present study. Furthermore, we expect the rate of conscious recollection (“Remember” responses) to be higher for faces shown with direct gaze compared to faces shown with deviated gaze.

Experiment 2

Method

Participants

Twenty-four undergraduates (13 women and 11 men) aged between 18 and 24 years (mean age = 20.6) volunteered. They all had normal or corrected-to-normal vision. All participants gave written informed consent.

Stimulus materials and procedure

Procedure and stimuli of the encoding phase were identical to those used in Experiment 1. At recognition phase, while stimuli were the same as those presented in Experiment 1, the recognition task was a “yes/no” choice to which the “Remember/Know/Guess” paradigm was added. Therefore, once the participant has reported whether the face has been seen in the previous task or not, the stimulus disappeared. If the recognition decision was “no”, then the inter-trial interval started. If the decision was “yes”, participants gave a “Remember”, “Know”, or “Guess” response by pressing a key on the numeric keypad of the computer, with 1 = Remember, 2 = Know, and 3 = Guess. The given instructions regarding the states of awareness were similar to those used in previous studies. They were told that a remember response meant that recognizing the face brought back to mind something they experienced when they saw the face in the study phase, and that this might include an image, a feeling, or an association formed then (e.g. ‘he looks like my cousin’ or ‘she has a big nose’), or even something about the timing of its presentation (e.g. that face was presented at the end of the series). They were told that a know response meant that they believed that the face occurred in the study phase because it was familiar in the experimental context, but they did not remember any details about what they had thought or felt when they saw the face. They were

also told that when they were not sure that a face had been presented in the first phase, giving a guess response was appropriate. Finally they were asked to refrain from guessing as much as possible. The time necessary to give instructions for the recognition task (including the Remember / Know / Guess judgments) was 4 minutes approximately. Participants were provided with a written summary of these instructions and were allowed to keep it during the execution of the task.

The counterbalancing procedure was exactly the same as in Experiment 1.

Results and discussion

At the encoding phase, error rates were very small (2.7 % on average) and were not submitted to further analysis. Average median RTs to face displaying direct gaze ($M = 594$ ms, $SD = 91$) were not significantly different from those to faces displaying averted gaze ($M = 578$ ms, $SD = 86$) at gender classification task, $t(23) = 1.73$; $p = .10$.

The rates of hits were not significantly different for direct and deviated gaze conditions, $t < 1$. Furthermore, the analyses separately carried out on Remember, Know, and Guess responses at the recognition phase revealed no significant difference between the direct and the deviated gaze conditions, all $ts < 1$. Analysis of d' and C measures did not show neither significant difference between the two conditions of gaze, $p > .20$. However we obtained a marginally significant effect of gaze direction on false alarm rates, $t(23) = 1.95$; $p = .06$ (see Table 3). Analysis also showed an effect of gaze on the rates of incorrect “Know” responses (false alarms “Know”) but given the low values, this effect probably reflects a floor effect, $t(23) = 2.16$; $p < .05$. Descriptive data are presented in Table 3.

INSERT TABLE 3 ABOUT HERE

Contrary to what was expected, even when using stimuli which allowed us to obtain the direct gaze effect in Experiment 1, we failed to obtain a higher rate of “Remember” responses for direct than for deviated gazes. Moreover, we did not obtain any significant difference between the rates of hits. Therefore, taken together, results of the first two experiments of the present study show that it is possible to replicate the effect of direct gaze on hits with Vuilleumier et al’s (2005) stimuli when the task at the recognition phase was a simple “yes-no” choice *but not* when the recognition task involved the “Remember/Know/Guess” paradigm. Hence, it remains possible that the “Remember/Know/Guess” paradigm hinders the occurrence of the effect. This could also explain divergence of results between Daury’s (2009) and those of previous experiments. In order to explore that possibility, in a third experiment, Daury’s (2009) stimuli were used with a simple “yes-no” recognition task. If an effect of gaze on performance is obtained, we could conclude that the failure to replicate was not due to the stimuli but rather to the recognition task used (“Yes/No” vs “Remember/Know/Guess”).

Experiment 3

Method

Participants

Sixteen undergraduates (8 women and 8 men) aged between 16 and 24 years (mean age = 20.4) volunteered. They all had normal or corrected-to-normal vision. All participants gave written informed consent.

Stimulus materials and procedure

Stimuli used in this experiment were those used in Daury's (2009) study, i.e. 32 faces unknown to the participants with a neutral facial expression and no facial hair or glasses (see Figure 1).

In the encoding phase, participants were presented with 16 faces in three-quarters profile views (deviated by 22.5° from the observer), half with a direct gaze and the other half with a deviated gaze (deviated by 22.5° from the observer as well).

After the filler task completed (same as in Experiment 1 and 2), participants were presented again with 32 faces (16 targets and 16 lures) in frontal views.

Counterbalancing, time courses and performed tasks were exactly the same as in Experiment 1. Procedure was identical to that used in Experiment 1 excepted that participants were shown 16 faces at the encoding phase and 32 at the recognition task.

Results and discussion

At the encoding phase, error rates were again very small (2.3 % on average) and were not submitted to further analysis. Analysis on average median RTs showed a tendency of the gaze direction to influence the speed of the gender classification task performing, $t(15) = 1.83$; $p =$

.09. Faces displaying direct gaze ($M = 613$ ms, $SD = 117$) tended to be classified more quickly than faces displaying deviated gaze ($M = 641$ ms, $SD = 156$).

The analysis carried out on hits at recognition task revealed no significant difference between direct and deviated gaze conditions, $t(15) < 1$.

The false alarm rates were not significantly different between both directions of gaze, $t(15) < 1$. The mean d' and C for faces with direct gaze were not significantly different from the mean d' and C for faces with deviated gaze, all $ps > .70$. Descriptive data are presented in Table 4.

INSERT TABLE 4 ABOUT HERE

In conclusion, once again faces displaying direct gaze did not elicit more hits than faces displaying deviated gaze even without using the “Remember/Know/Guess” paradigm. Therefore, those results suggest that not only the type of recognition task, but also the set of stimuli seem to prevent the effect of gaze direction to occur.

In order to test another recognition task, requiring a metacognitive activity, as the “Remember/Know/Guess” paradigm does, we decided to add a confidence rating to the procedure of Experiment 1. Hence, in a fourth experiment, we used again the Vuilleumier et al. (2005) stimuli with a “yes-no” recognition task, asking participant to rate the confidence they have in each of their answers.

Experiment 4

Method

Participants

Twenty-four undergraduates (13 women and 11 men) aged between 18 and 26 years (mean age = 20) volunteered. They all had normal or corrected-to-normal vision. All participants gave written informed consent.

Stimulus materials and procedure

Stimuli were the same as those used in Experiment 1 and 2, i.e. stimuli from Vuilleumier et al. (2005). Procedure was the same as that used in Experiment 1 and 3 except that, at recognition phase, after the “yes-no” choice was made, stimulus disappeared and participants gave a confidence rating by pressing a key on the numeric keypad of the computer, from 1 (not confident) to 5 (highly confident).

Results and discussion

An alpha level of .05 was used for all statistical tests.

At the encoding phase, error rates were very small again (2.4 % on average) and were not submitted to further analysis. Average median RTs to face displaying direct gaze ($M = 657$ ms, $SD = 124$) and to faces displaying deviated gaze ($M = 648$ ms, $SD = 122$) were not significantly different at the gender classification task, $t(23) = 0.72$; $p = .48$.

For the recognition phase, the rates of hits, false alarms, and associated confidence ratings were computed for each participant and each condition. The analyses carried out on hits revealed no significant effect of gaze direction, $t(23) < 1$. Confidence ratings were not significantly different for correct answers to faces with direct gaze compared with those for

correct answers to faces with deviated gaze, $t(23) = 1.29$; $p = .21$. The false alarm rates and associated confidence ratings were not significantly different neither between both directions of gaze, all $ps > .10$.

The mean d' and C for faces with direct gaze were not significantly different from the mean d' and C for faces with deviated gaze, $ts < 1$. All descriptive data are presented in Table 5.

INSERT TABLE 5 ABOUT HERE

In conclusion, the result of Experiment 1 was not replicated. Indeed, no effect of gaze direction was shown on recognition performance when participants were asked to evaluate confidence about their answers on a 5-point scale. Therefore, it seems that the addition of a confidence rating to the task prevented the effect of gaze direction to occur.

General discussion

The aim of the present study was to determine the factors and conditions that favour the occurrence of a direct gaze effect on overall performance in a face recognition task (i.e. rates of hits). Indeed, among studies which have reported a positive effect of eye contact on memory for faces, some experiments have shown that this effect was not so easy to obtain (Daury, 2009; Vuilleumier et al., 2005, frontal view of faces).

Two possible explanations were raised. The first one was the divergence between the different materials used. Compared with the Vuilleumier et al. (2005) profile stimuli, the angle of deviation of the eyes from the straight gaze of the Daury (2009) study was smaller (22.5° instead of 30°). Furthermore, Vuilleumier et al.'s (2005) stimuli revealed to be largely more distinctive (age range, bears, glasses ...) than Daury's (2009).

Second, the failure to replicate could emerge from the recognition task used. Indeed, the participants' spontaneous reactions showed that it was not easy to manage the "Remember/Know/Guess" paradigm (Daury, 2009). Instructions take time to be explained and to be understood. In addition, this paradigm requires inspecting one's own subjective memory; once the "yes" response selected, thinking about the right option to choose and so on. Some authors have recently reported that the brain shows variable ERPs when being in introspection or in non-introspection states of mind during a simple stimulus detection task (Overgaard, Koivisto, Sorensen, Vangkilde, & Revonsuo, 2006). Participants may have been engaged in different processes when responding a simple "yes-no" recognition task than when they had to inspect their subjective memories to give their answer.

The results of the present four experiments provide partial empirical support to the first explanation (set of stimuli). Indeed, while an effect of gaze direction was found using the Vuilleumier et al. (2005) stimuli and a simple "yes/no" recognition task (Experiment 1), we

failed to obtain a significant difference between direct and deviated gaze when using Daury's (2009) stimuli with the same procedure (Experiment 3).

Nevertheless, the second explanation (recognition task) should also be accepted. Indeed, when Vuilleumier et al.'s (2005) stimuli were used with the "Remember/Know/Guess" paradigm, the hit rates were no more significantly different between both directions of gaze.

Note that both of these factors (set of stimuli and recognition task) contribute to make the task harder to perform. Indeed, it is easier to recognize distinctive than common faces, because of their specific characteristics that constitute good retrieval cues for recognition (for a review, see Valentine, 1991). Secondly, as mentioned here above, using the "Remember/Know/Guess" paradigm seems to contribute to increase the difficulty of the task. An argument supporting this assumption is the comparison of global hit rates between Experiments 1 and 2: performance (hits) dropped by 15% on average when adding the "Remember/Know/Guess" paradigm to the recognition task. And varying these parameters seem to play an important role in the occurrence of the effect.

However, another and even more surprising absence of effect will lead us to integrate another element to our interpretation. This result came from Experiment 4 where participants were asked to report their confidence (between 1 and 5) in their answer. It seems that this simple confidence rating was enough to make the effect disappear. Indeed, the confidence rating was the only difference of procedure compared with Experiment 1 which yielded the direct gaze effect. Reporting how confident one is about his/her memory of the face is not very demanding. Yet the hit rates were equivalent for faces with direct gaze and with deviated gaze in that case while it was higher for faces with direct gaze when participants were not asked to report any confidence rating. Nevertheless, giving a confidence rating has something in common with the "Remember/Know/Guess" paradigm, that is, to involve a kind of

metacognitive activity, such as thinking about the memory of the face. Therefore, this result suggests that analysing, making the least judgement on the quality of the memory trace can cancel the effect.

From this result, the direct gaze effect might appear in what can be described as an incidental way. Asking participants to evaluate the quality of their memory trace, in terms of a subjective state of awareness or in terms of confidence, and consequently making the task more explicit, or even more complicated, might prevent the potential incidental influence of the eye contact on the recognition of the faces. Note that some electrophysiological studies have shown a potential early processing of gaze direction (~N170 or soon after) even if literature about that topic still shows inconsistent results (see Itier & Batty, 2009, for a review). It is possible that, contrary to what has been assumed in previous literature (Mason et al., 2004; Vuilleumier et al., 2005) the influence of gaze direction acts without any elaborate processing of the faces to be recognized. This would explain why we did not obtain any effect of gaze direction on “Remember” response rates either, conversely to what was expected (Experiment 2), failing to bring evidence that the effect of gaze direction on face recognition comes from a deeper processing at encoding phase.

Moreover, a more recent study (Turk, Cunningham, & Macrae, 2008) has demonstrated that it was possible to induce a memory bias by self-referencing without inducing any elaborate processing of the target information. Indeed, this study has shown that judging the spatial relationship between a self cue (such as the self-face or name) and the target information is enough to enhance the memory performance for this information. This finding can be applied to the present issue of gaze direction. Eye contact has regularly been considered as a kind of self-referencing (Kampe, Frith, & Frith, 2003; Schilbach et al., 2006). Those data fit our assumption, and allow postulating an incidental influence of gaze direction with suppression of this influence if anything comes to disrupt this incidental process, such as

making explicit metacognitive judgements about the memory response or making the task globally too complicated.

In conclusion, this study revealed that, both the kind of stimuli and recognition task are likely to hinder the effect of gaze direction on memory for faces that was reported earlier in the literature (Hood et al., 2003; Mason et al., 2004; Smith et al., 2006; Vuilleumier et al., 2005). Although the effect of direct gaze has been presented as beneficial to recognition memory, the present results and a close inspection of previously available data suggest that this effect is not so easy to obtain (Daury, 2009; Vuilleumier et al., 2005, for frontal views of faces). In their study, Vuilleumier et al. (2005) manipulated the orientation of the head at encoding (frontal and profile views) and obtained a direct gaze effect only when faces were presented in a profile view. Their results did not show any effect of gaze direction when using frontal views of faces (in opposition to Hood et al., 2003; Mason et al., 2004; and Smith et al., 2006). Hence, even if this effect is real, it appears to be a very sensitive effect, that occurs in highly specific conditions, and the influence of which on memory is probably more incidental than expected. Future research is needed in order to determine in which of these particular conditions the effect takes place and to investigate further the possibility of an incidental influence of direct gaze on memory for faces.

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	Stimuli (Faces)	Recognition task
Exp. 1	Vuilleumier et al. (2005)	"Yes/No"
Exp. 2	Vuilleumier et al. (2005)	"Yes/No" + "Remember/Know/Guess"
Exp. 3	Daury (2009)	"Yes/No"
Exp. 4	Vuilleumier et al. (2005)	"Yes/No" + confidence rating

Table 1: Stimuli and Recognition task used as a function of the Experiment.

<i>Gaze direction</i>	<i>Direct</i>		<i>Deviated</i>	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Hits	.694	.157	.604*	.174
False Alarms	.177	.108	.191	.140
<i>d'</i>	1.75	.95	1.57	1.11
<i>C</i>	.236	.375	.358	.447

Table 2. Mean proportions of hits, false alarms and mean *d'* and *C* at the recognition task as a function of gaze direction displayed at the encoding phase in Experiment 1. * The difference between direct and deviated gaze was significant at $p < .05$

<i>Gaze direction</i>	<i>Old</i>				<i>New (False alarms)</i>			
	<i>Direct</i>		<i>Deviated</i>		<i>Direct</i>		<i>Deviated</i>	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Recognition(R+K+G)	.502	.189	.491	.239	.083	.098	.132	.134
Remember	.253	.158	.240	.181	.024	.039	.017	.042
Know	.145	.101	.143	.103	.021	.044	.049	.055
Guess	.104	.089	.108	.097	.038	.049	.066	.078
<i>d'</i>	1.53	.59	1.31	.93				
<i>C</i>	.759	.452	.641	.526				

Table 3. Proportions of responses at the recognition task, d' and C as a function of gaze direction displayed at the encoding phase in Experiment 2.

<i>Gaze direction</i>	<i>Direct</i>		<i>Deviated</i>	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Hits	.602	.178	.609	.164
False Alarms	.156	.168	.117	.096
<i>d'</i>	1.54	.91	1.62	.78
<i>C</i>	.539	.496	.504	.329

Table 4. Mean proportions of hits, false alarm and mean d' and C at the recognition task as a function of gaze direction displayed at the encoding phase in Experiment 3.

<i>Gaze direction</i>	<i>Direct</i>		<i>Deviated</i>	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Hits	.573	.176	.583	.168
Confidence (hits)	3.34	.53	3.21	.49
False Alarms	.108	.100	.149	.115
Confidence (FA)	1.51	1.21	2.08	1.24
<i>d'</i>	1.56	.65	1.40	.61
<i>C</i>	.583	.373	.497	.344

Table 5. Mean proportions of hits, false alarms, associated confidence ratings and mean d' and C at the recognition task as a function of gaze direction displayed at the encoding phase in Experiment 1.