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INVOLUNTARY SOCIAL CUE INTEGRATION IN PATIENTS WITH OBSESSIVE COMPULSIVE DISORDER

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Abstract

Objective: Patients with Obsessive compulsive disorder (OCD) have inferior social functioning compared to healthy controls, but the exact nature of these social deficits, and the underpinning mechanisms, are unknown. We sought to investigate social functioning in patients with OCD by measuring their involuntary/spontaneous processing of social cues using a specifically designed test, which might reveal deficits in these patients that explicit voluntary tasks do not detect.

Methods: The sample of the study consisted of an OCD group (n=25) and a control group (n=26). Both groups performed an adaptation of the Social Distance Judgment Task (SDJT; Jellema et al., 2009), in which participants have to judge the geometrical distance between two human cartoon figures presented on a computer screen. Head/gaze direction and body direction were manipulated to be either compatible, i.e. both directed to the left or to the right (Compatible condition) or incompatible, i.e. body directed toward the observer (frontal view) and head/gaze directed to the left or right (Incompatible condition).

Results: In the Compatible condition, controls nor OCD patients were influenced by the social cues in their judgments of the geometrical distances. However, in the Incompatible condition, where the attentional cue was more conspicuous, both groups were influenced by the cues, but the controls to a significantly larger extent than the OCD patients.

Conclusions: This study showed that patients with OCD are less likely, compared to controls, to automatically/spontaneously integrate the other's direction of attention into their visual percept. This may have resulted in their judgments of the geometrical distances between the agents to be more accurate than those of controls. The suggested impairment in automatically

integrating social cues may have important repercussions for the social functioning of OCD patients.

1. Introduction

Obsessive compulsive disorder (OCD) is a frequently occurring illness in society and is associated with impairments in social functioning. This illness is typically characterized by obsessions, which are repetitive, penetrative, and undesirable thoughts, images, impulses, and compulsions, which may become manifest as repetitive behaviors or mental acts [1]. Patients with OCD have inferior social functioning compared with healthy controls [2,3], but the exact nature of these social deficits and the underpinning mechanisms are unknown. With respect to perspective taking and Theory of Mind (i.e. attributing mental states and beliefs to one self and to others) [4], conflicting results have been obtained. For example, Kang and co-workers found that OCD patients have a deficit in social perspective taking [5], while Fontenelle and co-workers reported normal perspective taking [6]. Sayın and co-workers indicated that although patients with OCD did not differ from controls with regard to standard theory of mind (ToM) abilities, they performed worse than controls with regard to advanced ToM abilities (e.g. understanding double bluffs in stories) [7]. Also with respect to emotion recognition there are mixed results. Some studies of emotion recognition reported no deficit [8,9], while others indicated a limited deficit in OCD patients [10,11].

However, all of the above mentioned studies measured explicit mentalizing abilities rather than the automatic, or spontaneous, mentalizing abilities that are typically used in daily life [12]. From social cues, such as gaze direction and body posture, the intentions

underpinning others' actions can be inferred. To establish successful social relationships, one should therefore be able to instantaneously interpret the fast-changing social cues and integrate them with other concurrent stimuli, without much conscious effort [13,14]. Despite the obvious relevance of implicit social cue processing for social functioning, it has hardly been studied in OCD.

In the current study, we sought to investigate social functioning in patients with OCD by measuring their automatic/spontaneous processing of social cues using a specifically designed test, which should reveal deficits in social functioning in these patients that explicit tasks might not detect. The current study used an adaptation of the Social Distance Judgment Task (SDJT) [15], in which participants have to judge the geometrical distance between two agents presented on a computer screen. The direction of the agents' head orientation (which was always compatible with gaze direction) and direction of body posture (either standing still or running) were manipulated. Both head/gaze direction and body orientation are social cues conveying the direction of social attention [14]. Healthy individuals were shown to be influenced by these cues in their judgments of the distance between the agents, such that when the cartoons' gaze directions and running body postures were directed toward each other the geometrical distance between them was judged as smaller than when these cues were directed away from each other [15,16]. The SDJT task measures the ability to automatically/spontaneously process and integrate social cues. The cues are task-irrelevant, in that to correctly judge the geometrical distance between two objects they could be ignored.

The current study zoomed in on cues of social attention (head/gaze direction and body direction) by removing the implied motion cue (running postures) from the SDJT, and by introducing cue-incompatibility for the static (standing still) postures. Thus, the agents were

shown in static postures throughout the task, while their body direction and head/gaze direction could be either compatible (both to the left or both to the right) or incompatible (body to the front, head/gaze to the left or right). In this way any 'contamination' by (in)sensitivity to implied motion was avoided, which should increase the test's sensitivity for measuring the ability to involuntarily process and integrate the social attention cues. It was envisaged that, due to its conspicuousness, the incompatible cue (head/gaze rotated over the shoulder) would be especially effective in conveying social attention [17].

The aim of this study was to examine whether patients with OCD show impaired automatic/spontaneous integration of social cues compared with healthy controls. If this is so than the distance judgments of patients with OCD should be less influenced by the social cue directions as compared to controls. The findings of this study may increase our awareness of deficits in social processing functions of patients with OCD and may help shed light on the underlying mechanisms. This study is to our knowledge the first to examine whether the social deficiencies in patients with OCD may be mediated by an impairment in implicit social cue processing.

2. Materials and methods

2.1. Participants

The clinical group consisted of 38 patients with OCD who had been referred to the Anxiety Disorders Outpatient Clinic of Pamukkale University, Hospital of the Faculty of Medicine, Department of Psychiatry, between August 2011 and December 2011. Specific exclusion criteria were mental retardation, the presence of a significant neurological or medical illness, a score of greater than 16 on the Hamilton Depression scale [18], a diagnosis of schizophrenia

or related illness, a diagnosis of bipolar disorder, and a history of alcohol or drug abuse. Four patients were excluded based on a score of greater than 16 on the Hamilton Depression scale, one patient for a diagnosis of schizophrenia , and one for a diagnosis of bipolar disorder. In addition, four patients were excluded because they did not provide consent, and three patients were excluded because they gave the same answer on more than 95% of the trials (excluding the catch trials). The remaining 25 participants comprised the patient group.

Nineteen patients with OCD who were on medication used high doses of selective serotonin reuptake inhibitors (SSRIs) and low doses of second-generation antipsychotics (SGAs). Two patients used fluoxetine, one patient used fluoxetine and an SGA, two patients used citalopram, three patients used sertraline, five patients used sertraline and an SGA, one patient used fluvoxamine, two patients used fluvoxamine and an SGA, one patient used paroxetine, one patient used chlomipramine, and one patient used SGA. The average SSRI doses were as follows: fluoxetine 60 mg/day, citalopram 25 mg/day, sertraline 160 mg/day, fluvoxamine 200 mg/day, paroxetine 60 mg/day, and chlomipramine 75 mg/day. The remaining six patients were drug free.

The control group consisted of hospital personnel and their acquaintances, which were matched in terms of age, gender and education level with the patient group. Three individuals, who gave the same answer on more than 95% of the trials (excluding the catch trials), were excluded, leaving 26 participants in the control group. See Table 1 for details of participant characteristics. All participants provided informed written consent at the beginning of the study. This study was in compliance with the Helsinki Declaration and was approved by the Pamukkale University Ethics Committee.

2.2. Procedure

2.2.1. Interview and Clinical Evaluation Scales

The sociodemographic and clinical characteristics of the participants were recorded during the psychiatric interview (Table 1). The Structured Clinical Interview for the DSM-IV, Clinical Version (SCID-I) [19], diagnosed OCD and other psychiatric disorders, was used. The prevalence of obsessive compulsive symptoms was evaluated using the Maudsley Obsessive Compulsive Scale (MOCI) [20]. The severity of these symptoms was determined for the OCD group using the Yale-Brown Obsessive Compulsive Inventory (Y-BOCS) [21,22]. The severity of depression and anxiety symptoms was evaluated using the Hamilton Depression Rating Scale (HDRS) [18] and Hamilton Anxiety Rating Scale (HARS) [23], respectively. Subsequently, participants completed the SDJT.

2.2.2. Stimuli and Experimental Protocol

A male cartoon figure, selected from the CorelDRAW Graphic Suite, was digitally adapted and used as stimulus [15]. In all stimuli the head and gaze directions were compatible (pointing in one and the same direction). Head direction and body direction were manipulated to be either compatible to each other, i.e. both directed to the left or to the right (Compatible condition) or incompatible, i.e. body directed toward the observer (frontal view) and head/gaze directed to the left or right (Incompatible condition). The cartoon figures were always presented in pairs as each other's mirror image (with a different colour of the jacket indicating they were different individuals; see Figure 1 for illustration of the stimuli). The cartoon figures were carefully digitally adapted to ensure an equal mass distribution, and equal outer dimensions, on either side of the vertical midline (Figure 1A), while the head and eyes were located exactly at the midline (Figure 1B). All faces had the same, neutral, expression.

The stimuli were presented on a 19-inch LCD monitor (resolution: 1440x900 pixels). Participants sat approximately one meter away from the monitor. Instructions and stimuli were presented using E-prime (E-prime Professional 2.0, Psychology Software Tools Inc., Pittsburgh, PA, USA). A trial began with the presentation of a single frame depicting two cartoon figures at a distance of 3, 4, or 5 cm from one another, for three seconds. Subsequently, a mask was displayed for one second, immediately followed by two rectangles in one frame that were also separated by 3, 4 or 5 cm, for three seconds (see Figure 1C). The height and width of the rectangles matched the outer dimensions of the corresponding cartoon figures. Participants had to determine whether the distance between the cartoons was smaller or larger than the distance between the rectangles. Participants pressed the "k" on the keyboard to indicate "I think the two cartoons were closer together than the two rectangles" and the "f" to indicate "I think the two cartoons were farther away from each other than the two rectangles". The frame showing the rectangles remained visible until participants provided an answer. Participants were instructed that the speed of responding was irrelevant, but that responses should be made within 3 sec. The instructions also informed participants that the distance between the cartoons and the distance between the rectangles were never equal, but that they could differ from just a few millimetres up to 2 cm. In fact, these distances were always equal, except in the nine catch trials were the cartoons were 2 cm closer to, or further away from, each other compared to the two rectangles. A 2 cm difference can easily be detected. Catch trials were inserted randomly within the task. Participants who made two or more mistakes in the catch trials were excluded from the study. Participants completed two practice trials before beginning the task to confirm that they had understood the instructions.

2.2.3. Statistical Analyses

Statistical analyses were performed using SPSS version 16.0 for Windows (SPSS Inc., Chicago, IL, USA). Continuous and categorical sociodemographic variables were compared using *t*-tests and χ^2 tests, respectively. Repeated measures ANOVAs were used to analyze the influence of the social cues on the distance judgments between and within groups. The relationships of the SDJT scores with the Y-BOCS and MOCI scores were examined using Pearson's correlation analyses (two-tailed).

3. Results

3.1 Sociodemographic and clinical variables

The OCD group consisted of 18 women (72%) and seven men (28%); the control group consisted of 16 women (61%) and 10 men (39%). Fifteen patients (60%) were married in the OCD group, while 18 participants (69%) were married in the control group. There were no significant between-group differences in terms of gender or marital status (χ^2 = .628, df = 1, p = .428 and χ^2 = .476, df = 1, p = .490, respectively). The groups also did not significantly differ in terms of age or level of education. Table 1 displays group demographic and clinical variables as well as clinical evaluation scale scores.

3.2. SDJT scores

An initial 2x2x2 ANOVA, with Compatibility (compatible vs. incompatible) and Gaze direction (away vs. towards) as within-subjects factors and Group (OCD vs. control) as

between-subjects factor, revealed a significant three-way interaction ($F[1, 49] = 5.71$, $p = .021$, $\eta_p^2 = .104$), allowing to analyse the Compatible and Incompatible conditions separately in 2x2 ANOVAs. In the Compatible condition (Figure 2, left panel), the main effect of Gaze direction was non-significant ($F(1, 49) = 1.61$, $p = .21$, $\eta_p^2 = .032$). The main effect of Group was significant ($F(1, 49) = 10.6$, $p = .002$, $\eta_p^2 = .18$), indicating that the OCD group, more often than the control group, believed that the cartoons were closer together than the rectangles. The Gaze by Group interaction was non-significant ($F(1, 49) = .85$, $p = .36$, $\eta_p^2 = .017$). The gaze direction of the cartoons did not affect the distance judgments of the OCD and control groups differently.

In the Incompatible condition (Figure 2, right panel), the main effect of Gaze direction was highly significant ($F(1, 49) = 34.35$, $p < .0001$, $\eta_p^2 = .41$), with participants believing that the distance between the cartoons directing their gaze toward each other was smaller than when they directed their gaze away from each other. This main effect of Gaze direction was qualified by a significant Gaze by Group interaction ($F(1, 49) = 4.24$, $p = .045$, $\eta_p^2 = .080$), reflecting that Gaze direction had a significantly larger effect on the control group than on the OCD group. T- tests showed that both the control and the OCD group tended to underestimate the distance when the cartoons directed their gaze toward each other as compared to when their gaze was directed away from each other (Controls: $t(25) = -5.38$, $p < .0001$; OCD: $t(24) = -2.82$, $p = .009$), but, crucially, the underestimation was significantly larger in the control group than in the OCD group. The main effect of Group was non-significant ($F(1, 49) = .227$, $p = .64$, $\eta_p^2 = .005$).

These findings suggest that in the Incompatible condition (where the head/gaze direction was averted with respect to the trunk) controls were more influenced by the agent's head/gaze direction than patients, while there was no such difference in the Compatible condition.

There were no significant correlations between the Y-BOCS or MOCI scores and the extent to which the distance judgments were influenced by the agent's gaze direction (expressed as responses 'gaze toward' minus 'gaze away') (all Ps > 0.05).

4. Discussion

This study examined the involuntary processing of others' direction of attention (as conveyed by head/gaze orientation) in individuals with OCD. The attentional cue was either compatible with body orientation (both pointing in the same direction) or incompatible (head rotated over the shoulder). The results indicated that when the agents' head/gaze cue was compatible with body orientation it had no influence on the participants' judgments of the geometrical distance between the agents, in both the OCD and control groups. Apparently, the gaze cue, when compatible with body orientation, did not convey a strong enough attentional signal to be able to influence responses. This finding confirms earlier reports of the SDJT in healthy individuals [15], in which the cartoon's standing still posture was used exclusively in a compatible configuration in which condition no gaze direction effect was found. However, the Incompatible condition did discriminate between the control and OCD groups. That is, even though in the Incompatible condition both groups were affected by the attentional cues, such that both groups underestimated the distance when the agents directed their attention toward each other (compared to attention directed away), for the OCD group this effect was significantly weaker than for the control group.

The finding that the influence of the head/gaze cue on the observer's responses when this cue pointed in a different direction than the body (Incompatible condition) was enhanced compared to when head and body pointed in the same direction (Compatible condition) is in

line with findings of experiments using gaze-cuing paradigms. These experiments show that gaze cuing is enhanced when the agent's gaze is averted with respect to head orientation as compared to gaze compatible with head orientation, and that gaze cuing is enhanced when the head is averted with respect to the trunk as compared to the head compatible with trunk [24]. However, it should be noted that these are reflexive spatial attention responses, which quickly fade out (within 500 msec), and therefore will not have played a role in the current paradigm in which the stimulus onset asynchrony was relatively long (4 sec). Nevertheless, it stresses the conspicuousness of incompatible cues, which may form a plausible explanation for the enhanced effect of the incompatible gaze cue. Looking over the shoulder reflects a heightened alertness on the part of the agent: something happened at the agent's left or right, which made the agent turn his/her head towards it. In other words, the observer caught the agent in the very act of redirecting his/her attention towards a target. In contrast, the compatible gaze cue hasn't got this sense of urgency about it and might just as well reflect the normal resting position.

An unanticipated finding in the Compatible condition was that, regardless of the gaze direction, patients with OCD perceived the distance between the cartoons as being shorter than the controls did. This cannot easily be explained in terms of susceptibility to a low-level visual illusion, as in the Jellema et al. [15] study, where it was proposed that the shape differences between the static and running cartoons played a role. Further experimentation is required to produce an explanation for the higher percentage 'cartoons closer' in the OCD group in the Compatible condition.

4.1. Possible explanations for the finding that the OCD group was less influenced by the attentional cue than the control group.

It seems plausible that when the head/gaze cue was compatible with body orientation, the attentional cue was relatively weak and therefore did not affect responses in either the OCD or control groups. When the gaze cue got more conspicuous (Incompatible condition), both groups were influenced by it, but the control group to a significantly larger extent than the OCD group. The higher resistance to the gaze-induced illusion in the OCD group may suggest that their involuntary attention to, or sensitivity for, an agent's gaze direction is compromised. It could also be that the problem is located in the integration of the social cues in the visual percept of the two cartoons. It has been suggested that OCD patients may have a deficit in integrating visual information [25,26]. Clearly, further experiments are needed to reveal the mechanism underlying the reduced influence of the social cues in the OCD group.

An interesting, alternative, view is that the deficiency in processing of other's direction of attention when the gaze/head was rotated over the shoulder (Incompatible condition) may have been (partly) due to a compromised ability to involuntarily adopt another's perspective. It has been argued that in order to be influenced by an incompatible gaze cue, one needs to (involuntarily) adopt the agent's frame of reference [17]. This means that an allo-centric (or object-centred) rather than an ego-centric (or viewer-centred) perspective should be employed. In an ego-centred system, the view and direction of articulation of the object are defined relative to the observer, whereas in an allo-centred description the principal axis of the object, or another part of the object, is taken as a reference point to define the action [27,28]. Although this notion is speculative, it is possible that an impairment in adopting another person's perspective contributed to the reduced influence of the incompatible gaze cue in the OCD group. Some support for this view comes from studies showing that patients with OCD may have deficits in the emotional awareness of, and the distinction between, self and others [29]. A deficit in the internal representation of self and others may be related to a

deficit in switching from an ego-centric to an allo-centric perspective. However, these questions cannot be answered here and require further experimentation.

The decreased involuntary influence of social signals, and/or impaired ability to adopt another's perspective, may underpin the social function deficits seen in OCD. These abilities are fundamentally important in establishing successful social relationships, and can cause patients with OCD to insufficiently understand, in an immediate and automatic manner, other's intentions. Such deficits in the implicit processing of social cues are characteristic for individuals with autism spectrum disorder [15,30] and also to some extent for healthy individuals having autistic-like traits [31]. Some studies indeed suggest that autistic traits are prevalent in patients with OCD [32-35]. Impaired sensitivity to gaze/head cues and/or impaired perspective taking may be markers for the proposed autistic subgroup in OCD, which group is considered to be more resistant to treatment [36]. However, this will have to be clarified in future studies, which take both sensitivity to social cues and autistic traits in OCD into account.

It cannot be excluded that the implicit attention deficiencies regarding gaze/head direction shown in our study are a symptom of a general implicit attention disorder. Besides reports of voluntary attention inhibition disorders in OCD [37,38], there are findings that suggest that there may be a general implicit attention deficit. For example, neuropsychological and neuroimaging studies have suggested that in patients with OCD the implicit memory system weakens as the explicit system becomes dominant within the parallel implicit-explicit cognitive system [39,40-42]. Further, evidence suggesting that indeed implicit rather than explicit cognitive processing may be affected in OCD comes from studies showing that the spontaneous learning of patients with OCD is flawed [43,44]. These findings may suggest that one of the reasons some studies find no deficits in perspective taking, theory of mind, or

emotion recognition tasks in OCD, may be that the methods used in these studies allowed to compensate for involuntary attention deficits by using voluntary attention.

A set of distributed brain structures, including the superior temporal sulcus, amygdala, orbito-frontal cortex, and anterior cingulate cortex, are responsible for recognizing and interpreting social cues, including those cues conveying social attention such as gaze, head and body direction [13,45,46]. This set of structures shows overlap with the structures that are most dysfunctional in patients with OCD [47-51], lending further support to the notion of a social cue processing impairment in OCD. However, imaging studies are needed to investigate this further.

To the best of our knowledge, the current study is the first to address possible deficits in the involuntary processing of social cues in individuals with OCD. Future studies should include non-social cues to determine whether the deficit in involuntary attention is limited to the social domain or whether it reflects a more general deficit.

4.2 Limitations of the study and conclusion

A limitation of the current study is that 19 of the 25 OCD patients were on medication, using high doses of SSRIs and low doses of SGAs. Even though it has been reported that these types of drugs do not significantly affect cognitive abilities [52,53], it may have affected the results of the correlation analysis. The absence of a correlation between the extent to which OCD patients were influenced by the gaze cues and the prevalence/severity of obsessive compulsive symptoms, may be partly caused by a reduction of obsessive compulsive symptom scores due to medication. Therefore, our findings should be verified in non-medicated patients with OCD.

Another limitation of the study is that insight into own symptoms was not measured in the OCD patients. This is relevant as it has been suggested that OCD patients with poor insight may have a different neuropsychological performance than their counterparts with good insight [54,55]. This issue should also be addressed in future studies.

In conclusion, this study showed that patients with OCD are less influenced by task-irrelevant gaze cues than controls. We speculated that the problem may be related to a failure to abandon a viewer- or ego-centred perspective in favour of an object- or allo-centred perspective, which would cause them to miss out on the enhanced conspicuousness of the incompatible gaze cue. However, more general low-level deficits in implicit attention, or in social cue integration, can currently not be excluded. Finally, the modification of the SDJT we introduced here, involving an incompatible condition for standing still postures, was effective in discriminating between the OCD and control group and should be added to the original SDJT [15] in future studies.

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Table-figure legends

Table 1. Group demographic and clinical characteristics and clinical rating scale scores.

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	Mean	SD	Mean	SD	t	df	p
Age	32.8	1.07	32.2	1.02	0.239	82	0.811
Years of education	11.3	3.4	11.7	4.2	-0.481	82	0.632
Duration of illness (years)	9.9	7.02					
Number of hospitalizations	0.7	1.3					
HDRS	6.88	4.15	4.15	1.73	7.578	82	0.000
HARS psychic	4.40	2.82	1.45	1.61	5.891	82	0.000
HARS somatic	2.35	2.58	0.40	0.85	4.649	82	0.000
Y-BOCS obsession	9.33	4.70					
Y-BOCS compulsion	8.35	4.11					
Maudsley Scale							
Checking	4.19	2.25	0.92	2.32	8.014	82	0.000
Cleaning	5.57	2.32	2.47	2.16	6.307	82	0.000
Slowness	3.14	1.78	1.07	1.11	6.373	82	0.000
Doubting	4.45	1.71	2.28	1.34	6.439	82	0.000
Rumination	5.28	2.72	1.78	2.13	6.550	82	0.000

Figure 1. Illustration of the stimuli and presentation sequence. (a) Head and body compatible, with the cartoons directing their attention at each other, is shown in the left panel. Head and body incompatible, with the cartoons directing their attention away from each other, is shown in the right panel. The outer dimensions of the cartoon figures (dotted lines) matched the height and width of the corresponding rectangles. The distances that had to be compared are indicated by arrows. (b) Symmetry within the cartoon figures for the compatible (left) and incompatible (right) conditions. (c) Example of the sequence of frame presentations in a single trial.

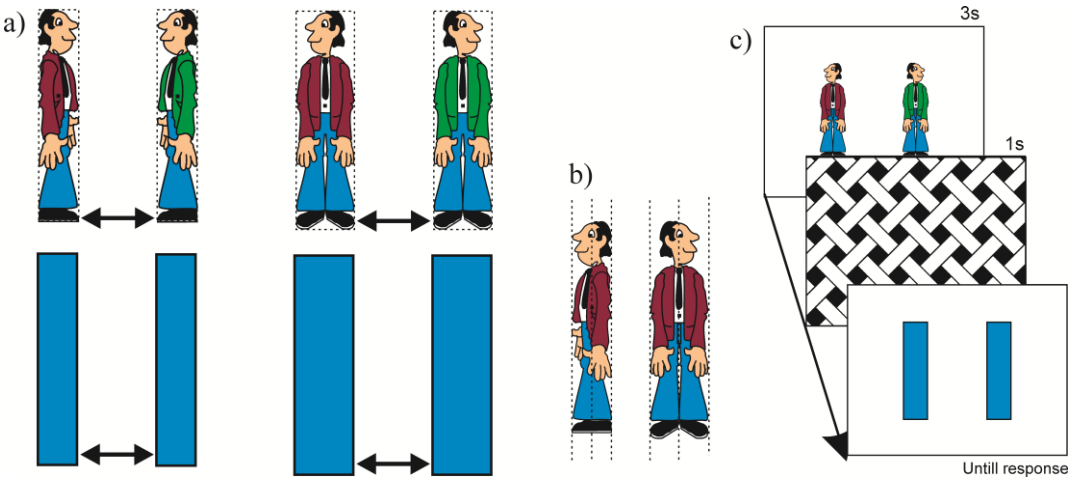

Figure 2. Main effect of Gaze direction in the Compatible and Incompatible conditions.