



Original article

Excessive checking behavior during an image comparison task in schizophrenia



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ABSTRACT

Background: Patients with schizophrenia display significant working memory and executive deficits. In patients with obsessive-compulsive disorder (OCD), several studies suggest that working memory dysfunction may be one of the causes of compulsive checking behaviors. Hence, this study aimed at assessing whether patients with schizophrenia were impaired on an image comparison task used to measure checking behaviors, and whether the origin and profile of impairment on this task was different between schizophrenia and OCD.

Methods: Eye movement recordings were used to assess the checking behavior of 24 patients with schizophrenia and 24 control participants who had to decide whether two images were different or identical. The verbal and visuo-spatial components of participants' working memory were measured using the reading span and backward location span tests.

Results: Compared to controls, patients with schizophrenia had reduced working memory spans and showed excessive checking behavior when comparing the two images. However, the intensity of their checking behavior was not significantly related to their working memory deficits.

Conclusions: Several recent studies demonstrated that the excessive checking behaviors displayed by patients with OCD were related to working memory dysfunction. The absence of a relationship between the excessive checking behavior of patients with schizophrenia and their working memory deficits suggests that checking behaviors do not have the same origin in the two disorders.

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1. Introduction

1.1. Cognitive models of excessive checking behaviors

The clinical symptoms of obsessive-compulsive disorder (OCD) often include compulsive checking behaviors [48,56]. The origin of the checking behaviors displayed by both healthy people and patients with OCD has received considerable attention in the literature. Several authors have suggested that OCD-like checking

behaviors could be related to memory deficits, such as impaired memory for actions and/or for the consequences of these actions [18,60]. However, the empirical findings about the memory deficits of patients with OCD are somewhat inconsistent. Indeed, most studies report that the episodic, non-verbal memory of patients with OCD is significantly impaired, but that their verbal memory and working memory are only mildly affected [2,18,34,36,54].

On account of these inconsistencies, alternative models of compulsive checking behavior have been developed. According to Rachman [46], compulsive checking would begin when people who feel that they have a particular responsibility for preventing harm do not know whether a potential threat has been removed. A large body of research suggests that in all individuals, repeated

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checking results in a decrease of the memory vividness and the memory confidence for the stimuli that are the object of checking [29,58,47]. Hence, checking behavior would result in an “object-specific” increase of doubt and uncertainty, which would perpetuate checking behavior [46].

Harkin and Kessler [27,28] suggest that compulsive checking is also due to disruptions of episodic representations in short-term working memory. Because of executive dysfunction, individuals with a high predisposition for checking would have trouble inhibiting distracting information or intrusive thoughts (such as uncertainty, see [37]) that disrupt the contents of working memory. In accordance with this idea, patients with OCD exhibit consistent deficits of executive functions [2,18,43,54]. As a result, they seem unable to efficiently organize pieces of information in order to easily memorize and retrieve them, and have trouble inhibiting distracting information [18,28,29]. This suggests that the working memory deficits found in patients with OCD are secondary to executive dysfunction, and are only revealed by working memory tests that require more complex encoding and retrieval strategies than simple span tests [28].

Recently, Jaafari et al. [34] evaluated the checking behavior of patients suffering from OCD by recording their eye movements during an image comparison task, in which participants had to decide whether two images were different or identical. In this modified version of the task designed by Rotgé et al. [51,50], the two images to compare were displayed simultaneously on the eye-tracker screen. The number of gaze moves made by participants between the two images prior to providing their response was taken as an index of their checking behavior. Using tests that demanded both storage and manipulation of information, i.e. which involved the central executive component of working memory [3], Jaafari et al. [34] also tested whether patients with OCD showed working memory impairment in relation to their checking behavior. As expected, patients with OCD made more gaze moves while comparing the images than healthy controls. More importantly, the working memory span of patients with OCD was lower than that of controls, and the patients' deficit in the image comparison task (i.e. the difference between each patient's performance and that of her or his individually-matched control) was negatively related to their working memory score. This suggests that in patients with OCD, the checking behavior elicited by an image comparison task is due at least in part to working memory dysfunction. Part of their working memory may be kept permanently busy by their obsessions and ruminations [1,34].

1.2. Cognitive dysfunctions and excessive checking behavior in schizophrenia

Recent meta-analyses and literature reviews suggest that patients with schizophrenia display stronger and more generalized cognitive deficits than patients with OCD [16,49]. Indeed, patients with schizophrenia show significant deficits in all executive tasks and working memory tasks, impaired attentional processes, and substantial impairment of their intellectual abilities [17,19,52]. In addition, their episodic memory is severely impaired, probably because of faulty encoding processes [49]. The origin of these broad cognitive deficits is still a matter of debate. While Dickinson and Harvey [16] suggest that they have biological underpinnings such as grey or white matter irregularities or abnormalities of neurotransmission, others have developed cognitive models of schizophrenia that do not involve such biological factors. For instance, Hemsley [31] proposed that the cognitive disturbance of patients with schizophrenia results from changes in the way the content of the patients' memory is integrated with sensory input and ongoing motor programs. This would provoke a weakening of

contextually-elicited responses and alterations of conscious experience. Several authors regard working memory impairment as a key explanatory point of schizophrenia [22,55]. Interestingly, however, meta-analyses demonstrated that there was no obvious link between patients' symptom profiles and the intensity of their working memory or executive functions impairment [15,19].

Because the cognitive deficits found in schizophrenia include those of working memory and executive dysfunction that are found to be involved in checking behaviors, one obvious question to emerge is to what extent the abnormal checking behaviors such as those revealed by the image comparison task [34] are specific of patients with OCD, or whether these can also be found in patients with schizophrenia. The literature indicates that there is some clinical overlap between OCD and schizophrenia symptoms [10]. Those patients with OCD, who have poor insight do not view their obsessions as senseless, and this can result in the development of delusional beliefs resembling those found in psychoses [35]. Some authors label such OCD patients as suffering from a schizo-obsessive subtype of OCD, or from obsessive psychosis. Conversely, the presence of obsessive-compulsive symptoms in some schizophrenic patients has long been recognized [26]. The prevalence of comorbidity for OCD in patients with schizophrenia has been estimated as high as 25% by some authors [6]. While observations suggest that some of these obsessive-compulsive symptoms could be side effects of treatment with second-generation antiserotonergic antipsychotics [53], several authors suggest that a schizo-obsessive subtype of schizophrenia may represent a distinct category [6,10,26].

Even among patients with schizophrenia who do not display obsessive-compulsive symptoms, excessive checking behaviors may be present though perhaps not for the same reasons as in patients with OCD. Indeed, patients with schizophrenia show impaired attentional processes and generalized deficits of executive functions, and have trouble encoding information in memory [16,17,19,31,49,52]. Hence, patients with schizophrenia might take more time to compare images because they have trouble encoding the different features of drawings, because they need more time to make their decision and/or because of a reduced speed of executive processing. Excessive checking behavior in schizophrenia might also result from undue perseveration, defined as an inappropriate and unintentional tendency to repeat the same behavior more than necessary. Many studies have demonstrated abnormal levels of perseverative responses in patients with schizophrenia, particularly in cognitively demanding tasks [12,59].

1.3. Goal of the experiment and main hypotheses

The main goal of the study was therefore to assess whether patients with schizophrenia who do not display high levels of obsessive-compulsive symptoms were impaired on the image comparison task as used by Jaafari et al. [34] to evaluate checking behavior. In addition, if impairment was found, the second aim was to compare the profile of this impairment between these patients with schizophrenia and the original sample of patients with OCD [34]. Since patients with schizophrenia suffer from severe deficits of all components of their working memory [19], both their verbal and visuo-spatial working memory spans were expected to be reduced compared to control participants. Because of the generalized cognitive impairment reported in the literature [8,31,49], patients with schizophrenia were also expected to perform worse than controls in the image comparison task. However, because of the unique compulsive character of the checking behaviors displayed by patients with OCD, patients with schizophrenia were expected to show a different profile of impairment. In particular, their individual performance on the image comparison task was not expected to be related to their working memory spans.

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