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Original article

How semantic content of stimuli works on episodic memory processes in negative schizophrenia: Evidence from picture recognition

Effet du contenu sémantique sur les processus en mémoire épisodique dans la schizophrénie négative : une tâche de reconnaissance d'images

L. Battal Merlet[a,b,*], A. Blanchet[a], H. Lockman[b], M. Kostova[a]

[a] *EA 2027, laboratoire de psychopathologie et neuropsychologie, université Paris 8, 2, rue de la Liberté, 93526 Saint-Denis cedex, France*
[b] *Psychological medicine department, university Malaya, Kuala Lumpur, Malaysia*

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ABSTRACT

Introduction. – Even though episodic memory is impaired in schizophrenia, semantic processing strategies can improve patients' performance. However, it is less clear if negative schizophrenia patients can benefit from semantic strategies, and if both familiarity and recollection processes can be enhanced in patients with schizophrenia.
Objective. – The aim of this study was to investigate the possibility for negative schizophrenia patients to enhance their familiarity and/or recollection processes in the presence of concrete images.
Method. – A recognition memory task using concrete versus abstract images as stimuli was designed to assess the performance of schizophrenia patients for single item recognition and the recollection of spatial context, allowing us to calculate the estimates of familiarity and recollection processes. Thirty-six patients with schizophrenia and 18 healthy individuals participated to the study. Schizophrenia patients were divided into two groups according to their scores on the negative scale of the Positive and Negative Syndrome Scale for Schizophrenia (PANSS).
Results. – Results showed that, while healthy participants enhanced their recollection estimates in the presence of concrete images, both schizophrenia groups could enhance their familiarity estimates.
Conclusion. – Semantic strategies are helpful to promote successful familiarity process in schizophrenia patients, independently from clinical dimension of negativity. However, recollection process seems not to respond to such strategies.

Mots clés :
Stratégies sémantiques
Images concrètes
Familiarité
Récupération contextuelle
Schizophrénie négative

RÉSUMÉ

Introduction. – Bien que la mémoire épisodique soit altérée chez les personnes atteintes de schizophrénie, des stratégies de type sémantique peuvent permettre aux patients d'améliorer leur performance. Cependant, il est moins bien établi si les patients schizophrènes avec des symptômes négatifs prédominants peuvent aussi répondre aux manipulations qui favorisent de telles stratégies, et si le processus de récupération contextuelle peut être amélioré.
Objectif. – L'objectif de cette étude était d'investiguer la possibilité pour des patients schizophrènes avec de symptômes négatifs prédominants d'augmenter leur performance pour la familiarité et/ou la récupération contextuelle en présence d'images concrètes.
Méthode. – Une tâche de mémoire de reconnaissance utilisant des images concrètes versus des images abstraites a été développée afin d'évaluer la performance des patients schizophrènes avec ou sans symptômes négatifs prédominants pour la reconnaissances des items et la récupération du contexte spatial, ce qui nous a permis de calculer les estimations des processus de familiarité et de récupération contextuelle. Trente-six patients schizophrènes et dix-huit personnes témoins ont participé à l'étude. Les patients schizophrènes ont été divisés en deux groupes selon l'importance de leurs symptômes négatifs évalués par la PANSS.

* Corresponding author. EA 2027, laboratoire de psychopathologie et neuropsychologie, université Paris 8, 2, rue de la Liberté, 93526 Saint-Denis cedex, France.
E-mail address: lale.merlet@yahoo.fr (L. Battal Merlet).

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Résultats. – Les résultats ont montré que, alors que des participants sains ont augmenté leur indice de récupération contextuelle en présence d'images concrètes, les patients schizophrènes, y compris ceux avec des symptômes négatifs prédominants ont augmenté leur indice de familiarité.
Conclusion. – Les stratégies sémantiques aident les patients schizophrènes à améliorer leur performance pour le processus de familiarité, et ceci indépendamment de la dimension clinique de la négativité. Cependant, le processus de récupération contextuelle semble ne pas être sensible à de telles manipulations.

1. Introduction

Episodic memory is impaired in schizophrenia (Aleman, Hijman, de Haan, & Kahn, 1999; Cirillo & Seidman, 2003; Danion, Huron, Vidailhet, & Berna, 2007; Heinrichs & Zakzanis, 1998; Leavitt & Goldberg, 2009). This impairment is related to strategic memory processing deficits (Bonner-Jackson & Barch, 2011; Danion et al., 2007). However, despite the deficits observed in the generation and the use of organizational strategies (Brebion, Amador, Smith, & Gorman, 1997; Brebion, David, Jones, & Pilowsky, 2004; Iddon, McKenna, Sahakian, & Robbins, 1998), research results indicate that schizophrenia patients improve their performance when appropriate semantic strategies are provided. For example, semantic processing of the stimuli during the study phase leads to increased episodic retrieval during the test for the items encoded at deep semantic level compared to the ones processed perceptively, in both healthy participants (Craik & Lockhart, 1972; Sheridan & Reingold, 2012; Toth, 1996; Yonelinas, 2002) and schizophrenia patients (Bonner-Jackson, Haut, Csernansky, & Barch, 2005; Ragland et al., 2003). Moreover, patients are receptive to semantic coherence of the stimuli (i.e. word pairs related to a given semantic category) to enhance their episodic memory performance (Battal Merlet, Morel, Blanchet, Lockman, & Kostova, 2014). Hence, the activation of prior semantic knowledge promotes successful episodic memory formation (Staresina, Gray, & Davachi, 2009) not only in healthy participants, but also in individuals with schizophrenia. This is understandable given that in schizophrenia the organization and the automatic activation of semantic memory are spared (Mohammad & DeLisi, 2013). Furthermore, the reinforcement of semantic context by the use of semantically related words and explicit semantic instructions help schizophrenia patients to consider the context during lexical decision tasks (Besche-Richard & Passerieux, 2003; Besche-Richard, Passerieux, & Hardy-Bayle, 2005). Also, cognitive remediation studies show that schizophrenia patients improve their performances for the treatment of ambiguous sentences when context oriented explicit instructions are provided (Besche-Richard et al., 2014). Thereby, semantic context, when structured and treated explicitly, seems to be helpful to promote better performance in both episodic and semantic memory tasks, providing a frame for the development of memory remediation techniques in schizophrenia.

Nevertheless, schizophrenia patients exhibit a clinical and cognitive heterogeneity (Ammari, Heinrichs, & Miles, 2010; Andreasen & Olsen, 1982; Joyce & Roiser, 2007; Picardi et al., 2012). Negative symptomatology is associated with more pronounced episodic memory deficit (Aleman et al., 1999; O'Leary et al., 2000; Pelletier, Achim, Montoya, Lal, & Lepage, 2005). Moreover, negative symptoms show a negative correlation with false alarm rates (Paz-Alonso et al., 2013) in paradigms such as DRM (Deese-Roediger-McDermott), (Roediger & McDermott, 1995), which increase false alarm rates in healthy individuals, suggesting that schizophrenia patients with more negative symptoms are less sensitive to semantic processing manipulations. Since the episodic interpretation of the semantic content seems to be a mechanism underlying false alarms in this paradigm (Cann, McRae, & Katz, 2011), the DRM data obtained with negative schizophrenia individuals could indicate an episodic memory deficit in those patients. Thus, it is less clear, if all schizophrenia patients, including those with more negative symptoms can benefit from semantic processing of the stimuli for improving their episodic memory performance.

On the other hand, episodic memory performance can be relied on two distinct processes: familiarity and recollection (Jacoby, 1991; Mandler, 1980; Yonelinas, 2001). Recollection refers to the retrieval of the information with its spatial (where) or temporal (when) context, whereas familiarity corresponds to the retrieval without contextual or associative details. Both familiarity and recollection processes are impaired in schizophrenia patients (Libby, Yonelinas, Ranganath, & Ragland, 2013) especially in those with negative symptoms (Thoma, Zoppelt, Wiebel, & Daum, 2006). However, while familiarity is mobilizable by the use of semantic strategies, recollection process seems not to respond to such manipulations (Battal Merlet et al., 2014; Ragland et al., 2006) when we consider schizophrenia patients as a whole, but it is not well established if clinical dimensions such as negativity play a role in these findings and if recollection process also can be enhanced in schizophrenia patients.

Studies investigating the effect of semantic strategies on episodic memory performance mostly employed verbal stimuli. Given that verbal memory is one of the most impaired cognitive functions in schizophrenia (Cirillo & Seidman, 2003; Heinrichs & Zakzanis, 1998; Toulopoulou, Morris, Rabe-Hesketh, & Murray, 2003; Toulopoulou & Murray, 2004), the use of pictures can be more appropriate for the investigation of the effect of semantic memory on episodic retrieval. Indeed, schizophrenia patients show the same degree of picture superiority effect as healthy controls in recognition memory tasks (Huron, Danion, Rizzo, Killofer, & Damiens, 2003). Picture superiority effect (Paivio, Rogers, & Smyth, 1968) refers to the fact that pictures are better recognized than words in recognition memory paradigms (Hockley, 2008; Rajaram, 1993; Snodgrass, Wasser, Finkelstein, & Goldberg, 1974). Better recognition of pictures relative to words is suggested to be in relation with their verbal labelling (Oates & Reder, 2010), in addition to their perceptive qualities, which creates a dual coding (Paivio & Csapo, 1973). On the other hand, the superiority of performance for concrete images in comparison to abstract ones was demonstrated in healthy individuals (Bellhouse-King & Standing, 2007; Nagata, 1986). Indeed, concrete images are easily and automatically verbalizable compared to abstract images, which do not automatically generate verbal labels, or labels generated are not specific (Oates & Reder, 2010). Thus, the use of concrete images can be promising for enhancing episodic memory performance in schizophrenia.

In light of above mentioned studies, in the present research, we aimed to investigate the effect of semantic memory on episodic retrieval processes in negative schizophrenia. We hypothesized that, schizophrenia patients, including those scoring higher on the negative scale of the positive and negative syndrome scale for schizophrenia (PANSS), (Kay, Fiszbein, & Opler, 1987) could benefit from the use of concrete images to enhance their performance, given that schizophrenia patients exhibit the picture superiority