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Behavioral predispositions to approach or avoid emotional words in schizophrenia

Jessica Sevos [a,b,*], Anne Grosselin [a,b], Tatyana Fedotova [a], Catherine Massoubre [a,c]

[a] Department of Psychiatry, University Hospital of Saint-Etienne, Saint-Etienne, France
[b] Epsylon Laboratory, EA4556, Dynamics of Human Abilities and Health Behaviors, University of Montpellier III, Montpellier, France
[c] EA TAPE, University of Jean Monnet, Saint-Étienne, France

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ABSTRACT

Many data suggest a disjunction between decreased emotional expressions and relatively preserved experience of and ability to assess emotions in schizophrenia. Based in an embodied approach of cognition, several studies have highlighted affective stimulus-response congruency effect in healthy subjects that show a direct link between the perception of emotion and associated motor responses. This study investigated whether the categorization of emotional words involves an automatic sensorimotor simulation of approach and avoidance behaviors. We asked 28 subjects with schizophrenia and 28 controls to execute arm movements of approach or avoidance to categorize emotional words, according to their valence (positive or negative). Controls were faster to respond to a positive stimulus with a movement of approach and a negative stimulus with a movement of avoidance (congruent condition) than to perform the inverted response movements (incongruent condition). However, responses of patients with schizophrenia did not differ according to congruence condition. Our results support the apparent non-involvement of covert sensorimotor simulation of approach and avoidance in the categorization of emotional stimuli by patients with schizophrenia, despite their understanding of the emotional valence of words. This absence of affective stimulus-response compatibility effect would imply a decoupling between emotional and bodily states in patients with schizophrenia.

1. Introduction

Emotion, as a complex system, is at the core of the interaction between the subject and its environment. In this view, emotions prepare the organism to adapt to various situations of everyday life and act accordingly. It is not surprising then that numerous studies of cognitive impairment in schizophrenia have focused on abnormalities in the processing of emotions that lead to functional disability (Hooker and Park, 2002; Herbener et al., 2008).

Indeed, numerous studies agree that patients suffering from schizophrenia have difficulty expressing emotions or recognizing emotions expressed by others, whether facially (Kring and Moran, 2008; Marwick and Hall, 2008; Kohler et al., 2010) or vocally (Hoekert et al., 2007). However, other studies show that their ability to experience emotions or assess emotional stimuli appears relatively intact (Kring and Moran, 2008). As examples, Herbener et al. (2008) described highly similar responses to emotional images across a wide range of valence (extremely negative to extremely positive) and arousal levels (calm to excited) reported by patients with schizophrenia and controls; in their study, Kring et al. (2003), asked participants to rate the similarity of the meaning of 120 pairs of emotional words, using a 7-points Likert scale (1: extremely dissimilar to 7: extremely similar). They demonstrated comparable assessments of affective stimuli among patients and controls.

Today, many data suggest no association between decreased emotional expressions (underpinned by the motor system) and decreased emotional experience in patients with schizophrenia (Heerey and Gold, 2007; St-Hilaire et al., 2008; Cohen and Minor, 2010). This expression/experience disjunction is found in response to social (Aghevli et al., 2003) and non-social stimuli (Kring and Earnst, 1999) and was suggested by Bleuler (1911), who postulated that patients with schizophrenia assess or experience a normal range of emotions but do not reflect them in their emotional expressions. This possible disjunction could also be assessed using a paradigm demonstrating a direct link between the perception of emotion and associated motor responses. To our knowledge, no study has examined the link between motor behaviors (e.g.

* Correspondence to: CHU de Saint-Etienne, Département de Psychiatrie de Bellevue, Pavillon 52A, 25 Boulevard Pasteur, 42055 Saint-Etienne Cedex 2, France.
E-mail address: j.sevos@hotmail.fr (J. Sevos).

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approach and avoidance), in response to emotional words in patients suffering from schizophrenia.

By contrast, several studies in healthy subjects have highlighted the interweaving of motor system function and response to emotional stimuli (Strack et al., 1988; Cacioppo et al., 1993; Förster and Strack, 1996; Chen and Bargh, 1999; Markman and Brendl, 2005; Havas et al., 2007; Dru and Cretenet, 2008; Freina et al., 2009; Van Dantzig et al., 2009). Based in an embodied approach of cognition, these works propose the grounding of the foundations of emotion in sensorimotor processes. Indeed, emotions are defined as patterns of perception, experience, physiology and expression/action that, all together, constitute cognitive responses that enable permanent interaction between the subject and situation (Niedenthal et al., 2005). This interaction is supported by sensorimotor simulations process, implemented in previous perception of the stimuli present in the environment or in the action performed in response to these stimuli (Jeannerod, 2006; Gallese, 2009). The simulation results in the recruitment of common neurons, which are activated when the subject is directly experiencing or perceiving a description of a situation, an action or an emotion (Glenberg, 1997; Barsalou, 2008). Thus, the nervous system can simulate an action in the absence of its effective realization by reenacting perceptual, motor and/or emotional states acquired during the subject's earlier experiences. The link between these different states has been shown to be bidirectional (Niedenthal et al., 2009; Brouillet et al., 2010): our perceptions and actions can both be influenced by our emotional state and can themselves influence our perceptions and more generally how we experience the world.

As an example, Cacioppo et al. (1993) demonstrated that participants evaluate more positively neutral stimulus (Chinese ideograph) while performing a movement of approach (arm flexed) than a movement of avoidance (arm extended; see also Neumann and Strack, 2000). Others studies have investigated the reverse effect, that is, how affective stimuli trigger approach and avoidance behaviors. Chen and Bargh (1999) identified affective stimulus-response congruency effects when they asked participants to categorize positive or negative words by making an arm movement. Indeed, such simulation should affect motor response if evaluating a positive or negative word activates a simulation of the object or entity to which it refers. They found faster response times in congruent condition (responding to positive words by pulling a lever and negative words by pushing it) than incongruent condition (responding to positive words by pushing the lever and negative words by pulling it). Their study also showed that the perception of emotional words involves the activation of the motor system through sensorimotor simulation; emotional categorization is facilitated by congruent movement and slowed by incongruent movement. Evaluating the specificity of this sensorimotor simulation more deeply, Freina et al. (2009, experiment 1) showed that a single meaning should not be assigned to the interpretation of a movement (i.e., flexion as positive and extension as negative) but that meaning should be determined based on the effect of the movement. For example, a movement must be understood as approach if it reduces the distance between the subject and the desired stimulus (regardless if the stimulus moves toward me or if I approach it) and as avoidance if it extends this distance (regardless if the stimulus moves away from me or if I avoid it; Strack and Deutsch, 2004; Seibt et al., 2008). Their results support the existence of an automatic sensorimotor simulation that is related to our emotional state during the perception of positive and negative stimuli and the dependence of that simulation on the desired goal or instruction given (Maxwell and Davidson, 2007). All these studies conclude that the movement influences the emotional perception and, in turn, the emotional perception automatically determines the movement of approach or avoidance to be implemented.

Using a stimulus-response congruency task based on an experimental framework of embodied cognition (Freina et al., 2009, experiment 1), the aim of our study is to investigate whether the perception of an emotion by subjects with schizophrenia involves an automatic sensorimotor simulation of action (approach and avoidance behavior). To our knowledge, no study has examined yet, in a categorization task, the coupling of perception and motor action underlying emotion in schizophrenia. If, in this pathology, the different components of emotions are no more associated (Kring and Earnst, 1999; Aghevli et al., 2003; Heerey and Gold, 2007; St-Hilaire et al., 2008), we could expect that, in schizophrenia, the realization of a specific motor action (approach or avoidance) and the emotional categorization of a perceived stimulus are no more interlinked.

2. Methods

2.1. Participants

Participants included 28 patients (26 men and 2 women) recruited in psychiatric departments of the University Hospital of Saint-Etienne and 28 healthy comparison subjects (25 men and 3 women) recruited at the hospital's restaurant. All were volunteers and naive about the hypothesis of the experiment.

Patients were included with a DSM-5 diagnosis of schizophrenia (American Psychiatric Association, 2013) and no change in antipsychotic medication and/or clinical status within four weeks prior to the study. All were stable outpatients living in their own accommodations and participating in various psychosocial or professional activities. Assessment of 26 patients by the same senior psychiatrist using the Positive And Negative Syndrome Scale (PANSS; Kay et al., 1987) showed relatively mild levels of psychiatric symptomatology (see Table 1). It was impossible to collect the scores for 2 patients (lost to follow up). Twenty-five patients were taking second generation antipsychotic medications, and 3, first generation medications. Moreover, all of them presented normal simple reaction times (battery TAP; Zimmermann and Fimm, 2005; see Table 1).

Across groups, participants were excluded for any history of a neurological disorder, including head trauma with loss of consciousness; dyskinetic phenomena or Parkinson-like tremors; mental retardation; and substance abuse within the preceding six months. All participants were right-handed (scores > 14, assessed by the modified Edinburgh Handedness Inventory; Oldfield, 1971).

Table 1
Means (SD) of demographic and clinical characteristics.

	Patients (N=28)			Controls (N=28)		
	Congruent	Incongruent	p	Congruent	Incongruent	p
Age (years)	35.8 (7)	35.6 (4)	.924	32 (8)	34.9 (8)	.314
Education (years)	11.4 (3)	11.9 (3)	.620	13 (1)	13.2 (2)	.730
Duration of illness (months)	135.6 (54)	138 (64)	.917	/	/	/
PANSS positive	14.9 (4)	13 (4)	.253	/	/	/
PANSS negative	16.6 (5)	14.5 (5)	.294	/	/	/
Reaction Times (ms)	270 (41)	254 (42)	.319			