



## Impact of emotionality on memory and meta-memory in schizophrenia using video sequences

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### ABSTRACT

**Background and Objectives:** A vast amount of memory and meta-memory research in schizophrenia shows that these patients perform worse on memory accuracy and hold false information with strong conviction compared to healthy controls. So far, studies investigating these effects mainly used traditional static stimulus material like word lists or pictures. The question remains whether these memory and meta-memory effects are also present in (1) more near-life dynamic situations (i.e., using standardized videos) and (2) whether emotionality has an influence on memory and meta-memory deficits (i.e., response confidence) in schizophrenia compared to healthy controls.

**Method:** Twenty-seven schizophrenia patients and 24 healthy controls were administered a newly developed emotional video paradigm with five videos differing in emotionality (positive, two negative, neutral, and delusional related). After each video, a recognition task required participants to make old–new discriminations along with confidence ratings, investigating memory accuracy and meta-memory deficits in more dynamic settings.

**Results:** For all but the positively valenced video, patients recognized fewer correct items compared to healthy controls, and did not differ with regard to the number of false memories for related items. In line with prior findings, schizophrenia patients showed more high-confident responses for misses and false memories for related items but displayed underconfidence for hits when compared to healthy controls, independent of emotionality.

**Limitations:** Limited sample size and control group; combined valence and arousal indicator for emotionality; general psychopathology indicator.

**Conclusions:** Emotionality differentially moderated memory accuracy, biases in schizophrenia patients compared to controls. Moreover, the meta-memory deficits identified in static paradigms also manifest in more dynamic settings near-life settings and seem to be independent of emotionality.

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### 1. Introduction

The vast amount of traditional memory research in schizophrenia patients suggests that these patients perform worse on standard recall and recognition tests, irrespective of the nature of the to be recollected stimuli (either episodic or semantically related; for reviews see Aleman, Hijman, de Haan, & Kahn, 1999; Ranganath, Minzenberg, & Ragland, 2008). This line of research is more recently complemented by studies focusing on possible disorder-specific memory biases like false memories and meta-memory deficits. With respect to false memories for contextually

plausible but new items, so-called critical lures within static word list or picture paradigms, it has been repeatedly found that schizophrenia patients do not produce more false memories (e.g., Moritz, Woodward, Cuttler, Whitman, & Watson, 2004; Peters et al., 2007) but sometimes to the contrary are less susceptible to false memory effects than controls (e.g., Elvevåg, Fisher, Weickert, Weinberger, & Goldberg, 2004).

In recent years, various studies have focused on how schizophrenia patients self reflect on their own memory processes, defined as meta-memory (see Dunlosky & Metcalfe, 2009). One key indicator for meta-memory, besides vividness (e.g., Cuervo-Lombard et al., 2007; D'Argembeau, Raffard, & Van der Linden, 2008), relates to the confidence in their retrieved answers (e.g., "I am 100% sure that this item was presented in the word list"; Dunlosky & Metcalfe, 2009). Memory researchers applying confidence indices to schizophrenia patients have identified that these

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patients are under-confident for correct responses while at the same time being overconfident for incorrect responses in comparisons to healthy and psychiatric controls. This pattern of results is termed ‘confidence gap’ (e.g., Moritz, Woodward, & Ruff, 2003). This confidence gap along with enhanced error rates contributes to higher rates of ‘knowledge corruption’, defined as an increased high confidence in erroneous judgments in schizophrenia patients as compared to both healthy and psychiatric controls (e.g., Moritz, Woodward, & Rodriguez-Raecke, 2006a). Theoretical foundations of this phenomenon were brought together in the liberal acceptance account (e.g., Moritz & Woodward, 2004; Moritz, Woodward, Jelinek, & Klinge, 2008). The essence of this account is that schizophrenia patients are very liberal in accepting incomplete information as sufficient when judging this information, making them prone to high-confident false judgments. In contrast, healthy participants tag incomplete information more easily as unreliable or “not trustworthy” thereby keeping high-confident errors in check. In schizophrenia patients, as opposed to other psychiatric conditions in which no knowledge corruption was identified (i.e., post traumatic stress disorder and obsessive compulsive disorder), overconfidence in errors has been found in acute and remitted stages, with non-delusional scenarios (Moritz & Woodward, 2006a,b) highlighting its specificity to schizophrenia pathology. Moreover, it is proposed that this reduced cognitive awareness of one’s own fallibility may predispose a person to fixed false beliefs that are at the core of schizophrenia.

### 1.1. The present study

So far, studies investigating these effects mainly used traditional static stimulus material like word lists or pictures (e.g., Moritz, Woodward, & Rodriguez-Raecke, 2006a). The question remains whether these memory and meta-memory effects are also present in (1) more near-life dynamic stimuli (i.e., standardized videos) and (2) whether emotionality has an influence on memory and meta-memory deficits (i.e., response confidence) in schizophrenia compared to healthy controls. Thus, can these findings be translated into more near-life situations? The memory outcomes from these more static paradigms are often used to make inferences about patients’ memory and meta-memory functioning in more dynamic contextual settings (i.e., real life). However it is unclear whether the results are applicable to settings where events are observed as dynamic sequences of action, rather than as a series of carefully spaced words or pictures. For this reason, replicating the current findings on memory and meta-memory in a more dynamic contextual setting using a newly developed paradigm is the first goal of this study.

Second, when considering memory and meta-memory deficits in schizophrenia, emotion likely plays a significant role (Herbener, 2008) as failure to integrate cognitive and emotional functions is stipulated as one of the hallmark symptoms in schizophrenia (e.g., Bleuler, 1924). Although schizophrenia patients and healthy controls seem to display a similar understanding of valence and arousal characteristics of emotional stimuli (Herbener, Song, Khine, & Sweeney, 2008; Matthews & Barch, 2004), schizophrenia patients seem to be impaired in memory for emotional experiences, although consensus on the phenomenology and clinical significance of these impairments is not yet reached. Whereas some studies demonstrated that similar patterns of memory are present for emotional words (either positive and negative) in schizophrenia patients and healthy controls (e.g., Matthews & Barch, 2004), other studies using similar methodologies found decreased recall of positive material (Herbener, Rosen, Khine, & Sweeney, 2007) or of both negative and positive material (Hall, Harris, McKirdy, Johnstone, & Lawrie, 2007) in schizophrenia patients compared to

controls. Still other studies have shown an intact emotionality effect and a preservation of the Pollyanna tendency (i.e., positivity bias) for schizophrenia patients (e.g., Danion, Kazes, Huron, & Karchouni, 2003; Neumann, Blairy, Lecompte, & Philippot, 2007) when comparing these patients to healthy controls. Furthermore, when overviewing the literature on emotionality and meta-memory in schizophrenia, research findings are limited and do not permit clear conclusions (e.g., Moritz, Woodward, & Rodriguez-Raecke, 2006a).

The present study aimed not only at replicating but also most importantly obtaining new insights related to memory and meta-memory deficits in schizophrenia patients by (1) using more dynamic stimuli (i.e., standardized videos) to (2) investigate the role of emotionality on memory and meta-memory deficits (i.e., response confidence) in schizophrenia. For the traditional memory accuracy and response biases it was hypothesized that schizophrenia patients would show impaired correct recognition memory but not more false memories compared to healthy controls. Furthermore, it was investigated whether emotionality would influence memory differently for both groups. For the confidence indices, it was expected that both samples differed on the extent to which confidence was expressed for correct and incorrect responses: an overconfidence for errors (i.e., misses and false alarms) in parallel to an underconfidence for correct recognition (i.e., decreased confidence gap) in the schizophrenia sample in contrast to the healthy controls. As the effects of emotional valence and arousal on meta-memory deficits are mixed until present, no specific predictions were made. Finally, the relationship between memory and meta-memory indices, psychopathology, and emotionality was investigated.

## 2. Method

### 2.1. Participants

Twenty-seven patients were recruited for this study at the Department of Psychiatry and Psychotherapy of the University Medical Center Hamburg-Eppendorf, Germany. All patients met criteria for either schizophrenia or schizo-affective disorder determined by the Mini International Neuropsychiatric Interview (M.I.N.I.; Sheehan et al., 1998) and file reviews (mean age in years = 37.96; SD = 12.86; Range = 45). Exclusion criteria for patients in this study were as follows: co-morbid substance dependency disorders, bipolar disorder, or severe neurological (e.g., epilepsy, traumatic brain injury, stroke, etc.) conditions. The Positive and Negative Syndrome Scale (PANSS; Kay, Opler, & Lindenmayer, 1989) was used to assess the severity of current schizophrenia symptomatology. Based on factor-analytic solutions of the PANSS scales (van der Gaag et al., 2006), five factors were composed: positive symptoms (including delusions, hallucinatory behavior, etc.), negative symptoms (including blunted affect, emotional withdrawal, etc.), disorganization (including poor attention, disorientation, etc.), excitement (including poor impulse control, excitement, etc.), and emotional distress (including anxiety, depression, etc.). All patients were medicated with antipsychotics, mostly with second-generation antipsychotic medication (see Table 1 for PANSS scores, mean number of hospitalizations and medication use).

An indication of verbal intelligence was established by means of a multiple-choice vocabulary test (*Mehrfachwahl-Wortschatz-Intelligenztest*; MWT-B; Lehrl, 1995). In this task, participants are presented with 37 lines of different words with each line containing only one correct German word and four distractor words that are phonologically similar to the target words. The distractor words are furthermore designed to appear orthographically plausible. The

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