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Monitoring what is real: The effects of modality and action on accuracy and type of reality monitoring error



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ABSTRACT

Reality monitoring refers to processes involved in distinguishing internally generated information from information presented in the external world, an activity thought to be based, in part, on assessment of activated features such as the amount and type of cognitive operations and perceptual content. Impairment in reality monitoring has been implicated in symptoms of mental illness and associated more widely with the occurrence of anomalous perceptions as well as false memories and beliefs. In the present experiment, the cognitive mechanisms of reality monitoring were probed in healthy individuals using a task that investigated the effects of stimulus modality (auditory vs visual) and the type of action undertaken during encoding (thought vs speech) on subsequent source memory. There was reduced source accuracy for auditory stimuli compared with visual, and when encoding was accompanied by thought as opposed to speech, and a greater rate of externalization than internalization errors that was stable across factors. Interpreted within the source monitoring framework (Johnson, Hashtroudi, & Lindsay, 1993), the results are consistent with the greater prevalence of clinically observed auditory than visual reality discrimination failures. The significance of these findings is discussed in light of theories of hallucinations, delusions and confabulation.

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1. Introduction

The source monitoring framework (SMF) proposes that memories do not contain labels or tags that directly specify their source, but instead that the origin of memories is

inferred, for example, from characteristic features (Johnson, Hashtroudi, & Lindsay, 1993). Such features might comprise: (i) contextual attributes such as spatial or temporal detail, (ii) sensory attributes such as colour or pitch, (iii) semantic information and emotional qualities, and (iv) internal cognitive operations such as those involved in reasoning or thinking

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about events. For example, if memory for a news story contains auditory but no visual features, its origin might be attributed to the radio rather than TV.

If the source monitoring judgement relates to the internal or external origin of the memory (that is, whether an event was imagined or really did occur), the attribution process is referred to as *reality monitoring* (Johnson & Raye, 1981). Memory traces of perceived and imagined events are different on average, with greater cognitive operations content for self-generated information and greater sensory and contextual detail in memories of perceived information. Johnson and Raye (1981, 2000) suggest that a decision about the internal or external nature of a memory is made based on a weighted combination of the active features during remembering, or via a matching process based on the characteristics of previous comparable memories. For example, if people hear some words from a speaker and imagine others, they are more likely later to mistakenly claim to have heard words that were only imagined, if their imagery was in the speaker's voice rather than in their own (Johnson, Foley, & Leach, 1988). According to the SMF, in addition to such relatively automatic heuristic attributions based on qualitative characteristics of mental experiences, reality monitoring (and source monitoring in general) also sometimes involves more deliberate/systematic processes that consider current experience in light of previous knowledge. For example, a 'memory' that is inconsistent with the report of someone else present at the time of an event might be doubted, whereas external 'evidence' (e.g., a train ticket) might increase confidence (Johnson, Suengas, Foley, & Raye, 1988).

An impairment in reality monitoring ability has been implicated in symptoms of mental illness and associated more widely with the occurrence of anomalous perceptions and false memories (Johnson, 1991; Johnson & Raye, 1998; McKay & Dennett, 2009; Radaelli, Benedetti, Cavallaro, Colombo, & Smeraldi, 2013; Turner, Cipolotti, & Shallice, 2010). For example, auditory verbal hallucinations may arise from a failure to recognise the self-generated nature of inner speech (Frith, 1992; Frith & Done, 1988; Hoffman, 1986). Such a proposal is supported by observations that patients with schizophrenia exhibit behavioral deficits in reality monitoring, which tend to be observed even in the absence of deficits in recognition memory (Fisher, McCoy, Poole, & Vinogradov, 2008; Keefe, Arnold, Bayen, McEvoy, & Wilson, 2002; Stephane, Kuskowski, McClannahan, Surerus, & Nelson, 2010; Szöke et al., 2009; Vinogradov et al., 1997; Vinogradov, Luks, Schulman, & Simpson, 2008). Such findings suggest there may be overlapping decision processes for determining the internal or external source of information that underlie both memory-based reality monitoring and the reality testing of current perceptual experience. Further evidence supporting this link comes from the observation that patients with schizophrenia exhibit reduced brain activity during reality monitoring tasks within the medial anterior prefrontal cortex (Garrison, 2015; Vinogradov et al., 2008), a region associated with discriminating real from imagined information (Simons, Davis, Gilbert, Frith, & Burgess, 2006; Simons, Henson, Gilbert, & Fletcher, 2008).

The processes involved in determining internal or external source during reality monitoring might apply not only to the

origin of memories and real-time perceptual information, but also to discriminating the origin of knowledge, attitudes and beliefs (Johnson, 1988, 1991; Slusher & Anderson, 1987). The observation of reality monitoring impairment in patients with schizophrenia who experience delusions (e.g., Thoresen et al., 2014) suggests that weakened reality monitoring may result in the establishment of a delusional belief through an initial hallucinatory false percept or unrecognised thought (Fletcher & Frith, 2009; Maher, 1974) and/or from failure of subsequent reasoning processes which supports the maintenance of the delusion (Turner & Coltheart, 2010), consistent with the SMF (Johnson, 1988; Johnson & Raye, 2000) and related two-factor theories of delusions (Coltheart, 2010). Reality monitoring impairment has been demonstrated in patients with anosognosia for hemiplegia compared to hemiplegic patients without anosognosia (Jenkinson, Edelstyn, Drakeford, & Ellis, 2009) suggesting a possible overlap between processes involved in monitoring action and perceptual information. Furthermore, a source monitoring explanation also accords with observations of reality monitoring impairment in individuals who experience false memories, such as patients with confabulations (Turner et al., 2010). Such individuals often exhibit temporal confusion (Schnider & Ptak, 1999) consistent with their failure to recognise an activated memory as pertaining to the past. A reality monitoring impairment during current thought or imagination might result in the experience of bizarre or fantastic confabulations, unrelated to reactivation of previous memory for previous events. Alternatively, spontaneous or provoked retrieval of a previous memory with insufficient source information might result in memory-based confabulations, with the error arising from the misattribution of mnemonic content to current experience.

An intriguing finding from the reality monitoring literature is that participants often exhibit an externalization bias as evidenced by a greater likelihood of falsely attributing new items to an external than internal source, or a greater proportion of imagined stimuli erroneously judged to have been perceived than perceived stimuli judged to have been imagined (Johnson, Raye, Foley, & Foley, 1981). There is much evidence for such an externalization bias in healthy individuals (Anderson, 1984; Foley, Johnson, & Raye, 1983; Hashtroudi, Johnson, & Chrosniak, 1989; Hicks, Marsh, & Ritschel, 2002; Johnson et al., 1981) and in patients with mental illnesses such as schizophrenia (Bentall, Baker, & Havers, 1991; Brébion et al., 2000; Brunelin et al., 2006; Seal, Crowe, & Cheung, 1997; Waters, Badcock, & Maybery, 2006; Woodward, Menon, & Whitman, 2007). Asymmetric source misattributions presumably reflect something about the evidence assessed and/or the criteria used in evaluating mental experience (Johnson et al., 1981; Marsh & Hicks, 1998). For example, a low threshold-level of perceptual information taken as evidence that information is external would produce externalization errors (Bentall & Slade, 1985). A belief that one would always remember generating an item (e.g., 'remember' cognitive operations information) would result in 'memories' without such information (e.g., false positives on new items) tending to be attributed to an external source (the 'it had to be you effect'; Johnson et al., 1981; Johnson & Raye, 1981). A recent meta-analysis suggests that a tendency to misattribute internal events to external sources is associated with

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