

Neural correlates of inner speech and auditory verbal hallucinations: A critical review and theoretical integration

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Abstract

The neuroimaging and neurophysiological literature on inner speech in healthy participants and those who experience auditory verbal hallucinations (AVHs) is reviewed. AVH-hearers in remission and controls do not differ neurologically on tasks involving low levels of verbal self-monitoring (VSM), such as reciting sentences in inner speech. In contrast, on tasks involving high levels of VSM, such as auditory verbal imagery, AVH-hearers in remission show less activation in areas including the middle and superior temporal gyri. This pattern of findings leads to a conundrum, given that mentation involving low levels of VSM is typically held to form the raw material for AVHs. We address this by noting that existing neuroimaging and neurophysiological studies have been based on unexamined assumptions about the form and developmental significance of inner speech. We set out a Vygotskian approach to AVHs which can account for why they are generally experienced as the voice of another person, with specific acoustic properties, and a tendency to take the form of commands. On this approach, which we argue is consistent with the neural correlates evidence, AVHs result from abnormalities in the transition between condensed and expanded dialogic inner speech. Further potential empirical tests of this model are discussed. © 2006 Elsevier Ltd. All rights reserved.

Keywords: Auditory verbal hallucinations; Dialogue; Inner speech; Verbal self-monitoring; Vygotsky

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Causes of auditory verbal hallucinations (AVHs), the experience of perceiving speech without corresponding external stimulation (Stephane, Barton, & Boutros, 2001), are still not well understood. Any theory claiming to offer an explanation of AVHs must be able to explain why a voice is heard in the absence of an external stimulus. In addition, any such account must explain why such a voice is experienced as generated or authored by an individual other than one's own self. A complete theory of AVHs must further be able to account for key features of the phenomenology of the experience. While the phenomenology of AVHs varies widely between different voice-hearers, broad themes can be extracted. One issue concerns the personal identity of the voice heard. While 28% of voice-hearers in a sample interviewed by Leudar, Thomas, McNally, and Glinski (1997) reported hearing only incognito voices, most (64%) reported hearing a voice which they could clearly identify as being that of a family member or acquaintance. Others, notably only those with a diagnosis of schizophrenia, reported hearing voices belonging to public figures.

Surveys of the numbers of different voices heard by voice-hearers have found an average of 2–3 voices (Leudar et al., 1997; Nayani & David, 1996). Ninety-six percent of voice-hearers in Leudar et al.'s (1997) sample reported being the target of the voice, which spoke to them rather than addressing another voice or another person. This highlights the fact that issues of the content and pragmatics of voices must also be addressed by a complete theory. Voices can attempt to perform a wide range of functions, including advising on possible actions, requesting specific actions, and inhibiting actions. However, AVHs most commonly take the form of commands, for example, 'Get the milk' or 'Go to the hospital' (Nayani & David, 1996). These command AVHs were reported by 84% of voice-hearers in Nayani and David's phenomenological survey and appear common in the autobiographical literature too. For example, North (1990) recalls how, during the period of her life when she was diagnosed with schizophrenia, she heard distinct voices issuing commands such as, 'Be good', 'Do bad', 'Stand up', and 'Sit down' (p. 60).

In summary, any satisfactory account of AVHs must be able to explain the following aspects of the experience: (1) why the AVH-hearer experiences a voice in the absence of any external stimulus; (2) why this voice is experienced as generated/authored by an individual other than one's own self; (3) why the voice is often perceived as having person-specific (e.g., acoustic) properties, distinct from one's own; and (4) why AVHs have characteristic contents and pragmatics, particularly their tendency to appear as second-person assertive utterances (e.g., commands). To date, no theory has been entirely successful in accounting for all of these aspects of the phenomenon, with the third and fourth criteria, in particular, rarely addressed. Our aim in this article is to present a theoretical framework which, we suggest, is sufficiently broad to do justice to the rich and varied phenomenology of AVHs. In doing so, we attempt what Bentall (1990) recommends a scientific theory of hallucinations should do, namely, "explain the experiences of the hallucinator in terms of underlying cognitive mechanisms" (p. 83).

In setting out our arguments, we will be drawing upon an assumption which has guided much thinking on AVHs, namely that they are a form of inner speech (Bentall, 2003; Bick & Kinsbourne, 1987; Fernyhough, 2004; Jones & Fernyhough, *in press*; Leudar & Thomas, 2000; Maudsley, 1886; Seal, Aleman, & McGuire, 2004). A *prima facie* case for the involvement of inner speech in AVHs concerns a basic commonality between the two kinds of experience, namely that both involve some form of internal verbal mentation, or 'voice in the head.' Furthermore, like inner speech, AVHs are often relevant to the voice-hearer's ongoing activities, and may attempt to comment on or regulate behavior (Leudar & Thomas, 2000). While other explanations of AVHs are possible (e.g., Hoffman & McGlashan, 1997; Lennox et al., 2000), the strong conceptual and empirical support for a relation between the two phenomena suggests that considering AVHs as a disorder of inner speech remains a fruitful line of enquiry. In this article, we propose that further light may be shone on the puzzle of AVHs through a more careful investigation of the nature and developmental significance of inner speech. Our arguments will be informed by the claims of L. S. Vygotsky (1934/1987) that inner speech can best be understood in terms of its being the endpoint of a developmental process. A guiding assumption, which we will argue is supported by empirical evidence from the study of children's speech, is that inner speech in healthy individuals is irreducibly dialogic in nature. We contend that AVHs result from an abnormality in the typical process of inner speech production, specifically the transition between condensed and expanded varieties of inner speech. These ideas require substantial unpacking and will now be more fully explicated.

1. Neuroimaging of inner speech and AVHs

Those working within the cognitive neuropsychology tradition typically view experiences such as AVHs as being underpinned by specific cognitive deficits or biases, which in turn must have neural instantiation. As remarked, many authors have proposed that the cognitive deficit involved in AVHs is a disorder of inner speech. Such a proposal is

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