

## Do We Need Multiple Models of Auditory Verbal Hallucinations? Examining the Phenomenological Fit of Cognitive and Neurological Models

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The causes of auditory verbal hallucinations (AVHs) are still unclear. The evidence for 2 prominent cognitive models of AVHs, one based on inner speech, the other on intrusions from memory, is briefly reviewed. The fit of these models, as well as neurological models, to the phenomenology of AVHs is then critically examined. It is argued that only a minority of AVHs, such as those with content clearly relating to verbalizations experienced surrounding previous trauma, are consistent with cognitive AVHs-as-memories models. Similarly, it is argued that current neurological models are only phenomenologically consistent with a limited subset of AVHs. In contrast, the phenomenology of the majority of AVHs, which involve voices attempting to regulate the ongoing actions of the voice hearer, are argued to be more consistent with inner speech-based models. It is concluded that subcategorizations of AVHs may be necessary, with each underpinned by different neurocognitive mechanisms. The need to study what is termed the dynamic developmental progression of AVHs is also highlighted. Future empirical research is suggested in this area.

*Key words:* development/psychosis/schizophrenia

### Introduction

The cognitive and neurological mechanisms involved in auditory verbal hallucinations (AVHs) remain poorly understood. With approximately two-thirds of patients with schizophrenia and 4% of the general population<sup>1</sup> reporting such experiences,<sup>1–3</sup> there is a clear need to understand this frequently distressing experience. The term AVH encapsulates a diverse phenomenological experience, which may involve single and/or multiple voices, who may be known and/or unknown, speaking sequentially and/or simultaneously, in the first, second, and/or third

person and which may give commands, comments, insults, or encouragement. Given the prima facie heterogeneity of AVHs, it is surprising that only recently has the suggestion been made<sup>4</sup> that “perhaps we now have to consider further subcategorizations of [auditory] hallucinations” (p. 118) and that this is likely to have important clinical, theoretical, and empirical implications.<sup>5,6</sup> This article aims to consider how well different cognitive and neurological models of AVHs accord with the phenomenology of the experience and what implications this has for potential subcategorization of the experience.

### *AVHs and Inner Speech*

One prominent type of model proposes AVHs to result from self-monitoring deficits leading to inner speech not being recognized as self-produced, and instead being perceived as an autonomous, nonself voice.<sup>7–10</sup> Inner speech has been defined in a variety of ways, ranging from the “subjective phenomenon of talking to oneself, of developing an auditory–articulatory image of speech without uttering a sound”<sup>11</sup> (p. 391) to “the overlapping region of thought and speech”<sup>8</sup> (p. 148), or simply “thinking in words”<sup>12</sup> (p. 596). Allen et al<sup>10</sup> have recently reviewed the behavioral and neuroimaging evidence for an involvement of inner speech in AVHs. They concluded that the behavioral evidence for impaired monitoring of inner speech relating to AVHs is “limited” (p. 416) and that the specificity of such a deficit to AVHs is “questionable” (p. 412) as impaired self-monitoring is also found in patients with delusions. However, studies of neural activation associated with AVHs, inner speech, and source monitoring were found to offer “more convincing evidence for the defective monitoring of inner speech in patients with hallucination” (p. 415). Such studies were argued to favor a disconnections model, in which speech production areas are unable to modulate the activity of the auditory cortex (ie, is disconnected from it) to signal that inner speech is self-generated, resulting in it being experienced as alien. Overall, Allen et al<sup>10</sup> concluded the existing neuroimaging evidence for an involvement of inner speech is stronger than the behavioral evidence, which is equivocal.

One limitation of review of Allen et al.’s<sup>10</sup> is that it did not attempt to evaluate inner speech-based models of

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AVHs on the basis of what can be termed an argument-from-phenomenology. Specifically, are AVHs phenomenologically consistent with inner speech? Recently, it has been claimed that an alternative cognitive model of AVHs, which conceives of such experiences as reactivated memories, concords well with the phenomenology of the experience.<sup>13</sup> This model will be briefly reviewed before evaluating it, as well as inner speech-based models of AVHs, by the argument-from-phenomenology.

### *AVHs as Memories*

West's<sup>14</sup> perceptual release theory proposed AVHs to be "previously recorded information: percepts, engrams, templates, neural traces, etc" (p. 281). In a cognitive reprise of elements of this model, Waters et al<sup>13</sup> have argued that auditory hallucinations (AHs), including AVHs, are a result of the "unintentional activation of memories" (p. 65) or "the failure to inhibit memories of prior events"<sup>15</sup> (p. 132).

Waters et al<sup>13</sup> propose that AHs result from 2 specific deficits. The first is a failure in intentional inhibition: the ability to deliberately suppress thoughts of an item after deciding it is irrelevant, a process which is effortful and available to conscious reflection.<sup>16</sup> This has been shown to result in intrusive thoughts, which occur more often in patients with schizophrenia with AVHs than healthy and psychiatric controls.<sup>17</sup> AVHs in the healthy population have also been linked to the presence of intrusive thoughts, potentially caused by failing thought suppression.<sup>18</sup> A number of studies have found failures of intentional inhibition in patients with schizophrenia with AVHs.<sup>15,19</sup> However, because some patients without AHs have also been found to have such deficits, Waters et al<sup>13</sup> suggest that a second deficit is necessary for the occurrence of AHs, namely a context memory deficit.

Waters et al<sup>13</sup> note that episodic memory research differentiates between an event's content and its context (the source or temporal characteristics surrounding the encoding of the event) and propose that in AHs the content of a memory is unintentionally activated, yet the context is not. This leads to these representations being confused with ongoing reality. Consistent with this, impaired processing of contextual information has been found in patients with schizophrenia with AHs.<sup>20</sup> More specifically, Waters et al<sup>21</sup> found that nearly all such patients tested had a context memory deficit. Patients were asked to watch or perform pairings of 2 different sets of 24 common objects over 2 sessions 30 minutes apart. In a recognition test performed 5 minutes later, patients were tested on their episodic memory ("did you see this pair?") and 2 forms of context memory: source context ("did you put the pair together or did the experimenter?"), and temporal context ("was the pair in the first or second set?"). A deficit in source context memory was found to be specific to patients with

AHs, whereas temporal context memory was found to be impaired in both hallucinating and nonhallucinating patients, compared with healthy controls. However, later studies have found temporal context memory deficits specific to those with AVHs.<sup>22</sup>

Waters et al<sup>13</sup> also provide evidence that the combination of context memory deficits and intentional inhibition is associated with AHs. When deficit was defined as performance 1 SD worse than controls, 90% of patients with current AHs were found to have deficits in context memory and intentional inhibition. Contrastingly, only 33% of patients (significantly less) with remitted AHs showed deficits in both context memory and intentional inhibition. In mapping these deficits to specific aspects of AHs, it has been argued that the failure of intentional inhibition leads to the intrusive cognition, with the failure of context memory resulting in it being not experienced as a product of one's own mind.<sup>23</sup> Overall, although weakened by the fact that some hallucinating patients do not show both deficits, and some nonhallucinating patients do show both deficits, intentional inhibition and context memory appear to be associated with AVHs.<sup>24</sup> However, whether these deficits play a causal role or derive from some other factor that causes AVHs is as yet unknown.

### **AVHs as Memories: A Phenomenological Fit to the Experience?**

In evaluating their model, Waters et al<sup>13</sup> claim "the proposal of auditory hallucinations as memories" is consistent with the phenomenology of the experience and can explain why "entire dialogues from a conversation may be recalled" and "why voices often refer to the patient's personal details" (p.76). However, this argument from phenomenology is based on only a limited number of forms of AVHs, without any comment by the authors on whether these forms are typical of the experience. A more detailed evaluation of this model based on the argument from phenomenology is hence required.

### *AVHs Consistent With Memory-Based Models*

The phenomenology of some AVHs do indeed appear to be consistent with the AVHs-as-memories account, particularly where the content of the AVH can be linked to memories of previous traumatic/abuse experiences. It seems likely that such AVHs are related to decontextualized intrusions of this material from memory. In accord with the perceptual quality of many AVHs, intrusive trauma memories tend to be sensory fragments of the traumatic experience.<sup>25</sup> There is substantial evidence demonstrating that hallucinations in general,<sup>26</sup> AVHs specifically<sup>27,28</sup> and particularly AVHs that take the form of commands to hurt the self or others,<sup>29</sup> are associated with earlier experiences of physical and sexual

abuse. However, there has been significantly less research into the concordance between the actual content of the AVH and the auditory experiences undergone during and surrounding such abuse. If actual memories associated with the trauma (eg, what an abuser said) are the basis of some AVHs, then concordance between the content of AVHs and trauma memories would be expected.

Direct evidence for this comes from findings showing that the content of AVHs can be linked to traumatic experiences. Read and Argyle<sup>30</sup> found, in 3 of 7 instances in which content of the AVHs of patients with schizophrenia was recorded, that the content could be linked to physical or sexual abuse. For example, command hallucinations to self-harm were found to be in the voice of the abuser. Similarly, Fowler<sup>31</sup> reported a history of trauma in 14 of 24 patients with psychosis who experienced hallucinations, and in 4 of these 14 patients the voice heard was appraised as being that of the abuser. In addition, some content of the voices matched utterances heard at the time of the abuse. Clinical experience also suggests that the content of AVHs in those who have experienced abuse/trauma can be related to what was said during, and surrounding, these events (eg, if you tell anyone I'll kill you). This has led Read et al<sup>32</sup> to claim that "some psychotic hallucinations appear to be nothing more or less than memories of traumatic events" (p. 341).

#### *AVHs Not Consistent With Memory-Based Models*

Despite the suggestive evidence above, further consideration shows the AVHs-as-memories account to be in phenomenological accordance with only a (relatively small) subset of AVHs. Firstly, in the study of Fowler<sup>31</sup> cited above, only in 4 of the total 24 voice hearers studied could the content of voices be seen as "sometimes" being suggestive that these were memories. In the remainder of the sample who had a history of trauma, meaningful connections could be made between the trauma and the voices. However, such connections were *thematic* (eg, both the voices and trauma involved humiliation) rather than involving a direct relation between the content of the voices and what was said during and surrounding the trauma. Similarly, another study<sup>33</sup> found only 7% of individuals with AVHs were rated as demonstrating clear concordance between the theme and content of the trauma and the themes and content of the voices. This study also found that 42% of people with hallucinations, who reported having current problems with past trauma, had no association between the content of their hallucinations and the past trauma.

Instead, Fowler et al<sup>34</sup> have noted that, in those who have experienced trauma, AVHs typically involve critical comments or comments about the person's day-to-day experiences. This observation is consistent with the conclusion of a study of AVH phenomenology in patients with schizophrenia and in those without any psychiatric

diagnoses, by Leudar et al.<sup>35</sup> This study concluded that AVHs are "focused on the regulation of everyday activities" (p. 896). Similarly, Nayani and David<sup>36</sup> note that 46% of their sample of patients with schizophrenia said their AVHs had come to replace their "voice of conscience" (p. 185) and that a proportion relied on their AVH for making decisions. Furthermore, AVHs were typically "minutely engaged in the apprehension of objective reality" (p. 185). It is hard to understand how intrusions from memory of past verbalizations could function in such a role. It is also worth noting that Nayani and David observe that AVHs tend to evolve over time with the voices "fashioning increasingly detailed dialogues with or about the patient" (p. 187). Again, it is hard to see how verbal intrusions from memory could create such an interactive dialogue with the voice-hearer.

That some AVHs are not simply an intrusive memory of verbalizations experienced in and surrounding trauma/abuse, or more generally, but are instead more of a dynamic creation, is suggested by the technique of voice dialogue.<sup>37</sup> In this process, a practitioner speaks to the voice hearer's AVH through the voice hearer. For example, the questioner may ask "what do you want" (addressing the voice hearer's AVH), and the voice hearer is asked to listen to their AVH's response to the therapist and report it verbatim (eg, "I want her to die"). The ability of some individuals with AVHs to engage in such dialogues (and no empirical work yet exists clarifying what percentage of those with AVHs can engage in such a process) suggests that they are not simply experiencing static intrusions from memory during this process but that the process is more dynamic and creative. Furthermore, when voice hearers themselves engage in a dialogue with their voices, the number of voices may multiply<sup>38</sup>, again pointing toward a more dynamic relation than simply static intrusions from memory.

Furthermore, other types of AVHs are hard to explain by this cognitive memory-based account. For example, AVHs may take the form of crowds of mumbling voices.<sup>36</sup> This seems an unusual form for an intrusive memory to take. While it is well documented that trauma leads to intrusive recollections of the experience and surrounding events,<sup>25</sup> it is unclear why anyone should experience an intrusive memory of mumbling voices. The same argument applies to nonverbal AHs. As Bleuer<sup>39</sup> noted, in addition to verbal AHs, "blowing, rustling, humming, rattling, shooting, thundering, music, crying and laughing" (p. 96) may also be heard. Although Waters et al<sup>13</sup> argue that their model can explain such types of AHs, it would appear that these experiences, with seemingly random content, are instead more parsimoniously accounted for by an bottom-up ictal-based neurological model (see below).<sup>36</sup>

In conclusion, what is to be made of the claim<sup>15</sup> that a model which views AVHs as "the failure to inhibit memories of prior events" (p. 132), and sees "auditory

hallucinations as memories”<sup>13</sup> (p. 76), is consistent with the phenomenology of the experience? It appears from the above that such AVHs-as-memories models can only account for the phenomenology of a minority of types of AVH. For example, this may be applicable to the ~10%–20%<sup>31,33</sup> of individuals whose voices include content that can be linked directly back to memories of trauma. However, the majority of AVHs, which phenomenological surveys have shown to be related to the ongoing patterns of activity in the voice hearer’s life, seem to be inconsistent with this account. Such observations, and the conclusion that AVHs cannot be satisfactorily understood as simply a “direct intrusive [auditory] image of the trauma event” (p.113) have led Fowler et al<sup>34</sup> to argue instead for an inner speech–based model.

### **AVHs as Inner Speech Based: A Phenomenological Fit to the Experience?**

Based on their findings that AVHs are typically “focused on the regulation of everyday activities ... and are characterized by the same dialogical structures one finds in ordinary speech” (p. 896) Leudar et al<sup>35</sup> have argued that AVHs are phenomenologically consistent with inner speech. It has also been argued elsewhere, building on a consideration of the form, function, and development of private and inner speech, that the phenomenology of many types of AVHs are consistent with a basis in inner speech.<sup>8,40</sup> For example, the high frequency of command AVHs, such as “get the milk” or “go to the hospital” (reported by 84% of voice hearers in Nayani and David’s<sup>36</sup> phenomenological survey) is consistent with inner speech’s developmental linkage with the control of action.<sup>41</sup> If some AVHs do indeed have a basis in inner speech, it should not be surprising that they frequently have a similar regulatory quality.

However, inner speech conceived of as simply speaking silently in one’s own voice is hard to reconcile with the phenomenology of AVHs that are typically experienced as hearing the voice of another person. For example, Nayani and David<sup>36</sup> found 71% of patients with schizophrenia reported that their AVH’s accent differed to their own. It has been argued that this could be explained by the voice-hearer making a post-hoc attribution of such inner speech to another person.<sup>2</sup> However, to argue that inner speech, conceived in this way, is the raw material of AVHs leads to a number of predictions that have been experimentally falsified. For example, if AVHs occur because such inner speech is misidentified, individuals with AVHs should presumably report less frequent inner speech. However, a recent study found little difference between patients with schizophrenia with AVHs and healthy controls in terms of the frequency and form of their inner speech.<sup>42</sup> Furthermore, when the form and content of inner speech (again conceived of as speaking silently in one’s own voice) of patients with schizophrenia

with AVHs are compared with controls, no differences are found, and the pragmatics of such patients’ inner speech are not related to the pragmatics of their AVHs.<sup>42</sup> Additionally, neuroimaging research has found that when patients with schizophrenia with AVHs simply speak silently in their own voice in inner speech, saying sentences such as “I like x,” patterns of neural activation do not differ to controls.<sup>43</sup>

In response to this, a number of recent inner speech–based models have attempted to explain why inner speech/verbal thought may sometimes involve not speaking in our own voice but instead taking another individual’s perspective on our experiences.<sup>8</sup> A Vygotskian approach to inner speech has proposed that our thinking takes the form of a dialogue that is literally shot through with other voices.<sup>44</sup> Similarly, Dialogical Self Theory proposes that inner speech can involve multiple sets of characters, with autonomous thought centers, that interact in verbal and nonverbal dialogical forms in an imaginal space.<sup>45,46</sup> Another approach comes from Fowler et al,<sup>34</sup> who have proposed a basis for AVHs in inner speech but inner speech conceived of as rumination and inner dialogue. Specifically, due to the association between abuse and AVHs, Fowler et al<sup>34</sup> propose rumination or inner dialogue about interactions with an abuser may be the raw material for many AVHs. This would predict the content of AVHs to be likely to “reflect patterns of rumination or internal dialogue about self in relationship to what a shaming and insulting abuser might say about one’s current actions” (p. 113). Such an account is hence consistent with the phenomenology of many AVHs that, as noted above, are not the same as what was said during/surrounding earlier trauma, yet related to it.

Other similar inner speech–based accounts have also been developed. Such accounts have proposed that individual differences in the tendency to ruminate and perform imaginative verbal dialogues involving others may act as a risk factor for AVHs<sup>47</sup>, or that “vivid and perceptual imagination”, in combination with source monitoring deficits and particular metacognitive beliefs, may be the main constituent of AVHs. Although the ability to produce imagined speech of others does itself not appear to be impaired in patients with AVHs,<sup>48</sup> I have argued elsewhere<sup>8</sup> that neuroimaging studies of patients with schizophrenia with AVHs showing atypical neural activation associated with the ability to silently imagine another’s voice speaking to oneself,<sup>43</sup> are consistent with involvement for this type of inner speech in AVHs. Hoffman and colleagues<sup>49</sup> have also recently noted this latter point, namely that “source monitoring mislabeling may selectively attach to verbal imagery of non-self speakers rather than ordinary inner speech” (p. 1172).

Inner speech–based theories are still left with the problem that AVHs are typically reported as having the phenomenological quality of being heard. For example, in a study by Leudar et al<sup>35</sup> all patients with schizophrenia

who heard voices, reported that it was “very much like hearing other people speak” (p. 889). One approach to reconciling this to the phenomenology of inner speech has been to suggest inner speech has more acoustical properties in voice-hearers. For example, a recent study found that approximately 40% of patients with schizophrenia with AVHs rated their own thoughts as having some acoustical properties (as opposed to being absolutely silent). This led the authors to argue that AVHs may be associated with abnormalities with sensory inner perception “which apparently arise already at the stage of thoughts”. An alternative approach is to question the degree to which an experience being labeled as a voice is to do with its acoustical properties. Stephens and Graham<sup>50</sup> have argued that “something can count as a voice without being experienced as audition-like or mistaken for sensory perception of another’s speech” (p. 114). In line with this, not all AVHs have the phenomenal qualities of a heard voice. Bleuler<sup>39</sup> noted that some “patients are not always sure that they are actually hearing the voices or whether they are only compelled to think them. There are such ‘vivid thoughts’ which are called voices by the patients” (p. 110). More recent studies have found that 38% of patients with schizophrenia with AVHs said their voices were not very real, 44% said their AVHs were more like ideas than external sensations<sup>36</sup>, and only 20% of patients said their voices were indistinguishable from auditory perceptions.<sup>51</sup>

Interestingly, inner speech models can predict the phenomenology of one of the more unusual forms of AVHs. Vygotsky,<sup>41</sup> Fernyhough has noted,<sup>44</sup> proposed that inner speech typically becomes syntactically and semantically condensed and abbreviated, losing most of its structural and acoustic qualities, becoming a process of “thinking in pure meanings”. If inner speech forms the raw material for AVHs then, in addition to fully formed words or sentences being experienced as AVHs, it can be predicted that some would also have this quality of “pure meaning”. Frith<sup>52</sup> has described this as the experience of receiving information without any sensory component. Such types of AVHs have indeed been documented. Bleuler<sup>39</sup> termed these “soundless voices” (p. 110). In such AVHs a message or meaning is communicated although it is not actually heard. For example, a patient of Bleuler’s who threw himself into the Rhine reported afterwards that “It was *as if* someone pointed his finger at me and said “Go and drown yourself” (p. 111, italics added). Janet also noted this phenomenon, giving the example of a patient who reported that “it is not a voice, I do not hear anything, I sense that I am spoken to”.<sup>53</sup>

In conclusion, the phenomenology of inner speech, including its regulatory nature, its linkage to ongoing events, its ability to involve the voices and perspectives of others, its ability to take the form of “thinking in pure meanings”, and its creative nature, are consistent with the phenomenological properties of a large number

of AVHs. However, inner speech-based models have a number of limitations when compared to the phenomenology of AVHs. Firstly, they do not seem appropriate for the ~10-20% of individuals, as noted above, whose voices have content which can be linked directly back to memories of trauma. These instead appear better modeled as verbatim intrusions from memory. Secondly, as Waters et al.,<sup>13</sup> have argued, such models cannot explain other types of AVH, such as the voices of crowds, or other AHs, such as environmental noise and music. Indeed, Nayani and David<sup>36</sup> found the latter to be quite frequent, with 36% of patients with schizophrenia with AVHs also reporting musical hallucinations, and 16% reporting elemental sounds such as clicks and bangs. Thirdly, it may be worth considering Hurlburt and Schwitzgebel’s differentiation between inner speech and inner hearing.<sup>54</sup> These authors note that whilst inner speech is experienced as “going away”, “produced by”, and “under the control of” the individual, and is “just like speaking aloud except no sound”, in contrast inner hearing is the experience of a sound which is “coming toward”, “experienced by”, and “listened to” by the individual (p. 257). In these terms many AVHs are more phenomenologically consistent with inner hearing than inner speech. Despite these limitations, and in need of future empirical testing, inner speech-based models have the starting advantage of being in accordance with the phenomenology of a significant number of AVHs.

Overall, the arguments presented above suggest that the AVHs-as-memories model, and inner-speech based models, are both in accordance with the phenomenology of separate subsets of AVHs. However, neither model is consistent with the phenomenology of all AVHs. One possible conclusion is that both these models are correct, albeit each for a separate subset of AVHs. However, it is also worth considering an alternative view, namely that neither of these models is correct, with the appropriate explanation of AVHs lying at the neurological level rather than in cognition.

### Neurological Models and the Phenomenology of AVHs

It is possible that the mechanisms underlying AVHs do not fit neatly into any cognitive model. For example, complex visual hallucinations in epilepsy and Charles Bonnett syndrome have been explained by bottom-up neurological models involving deafferentation and neural circuitry disinhibition<sup>55</sup>, and are not readily accounted for by any cognitive mechanistic model. It has been proposed that an analogical model may be the appropriate level of explanation for AVHs.<sup>55</sup> The following section attempts to evaluate this, and other bottom-up neurological models, in terms of their ability to predict the observed phenomenology of AVHs.

Bottom-up neurological models of AVHs tend to reason from analogy from Penfield and Perot’s<sup>56</sup> studies

involving direct external electrical stimulation of the temporal cortex.<sup>4</sup> In these studies participants reported a range of AHs. Firstly, reports of musical hallucinations were common, such as “I hear music” (p. 620) and “I hear singing...it is White Christmas” (p. 618). Other forms of environmental sounds were also reported, such as “a toilet flushing or a dog barking” (p. 628). Secondly, voices were heard. These were typically overheard conversations, not directed at the individual, including “I heard someone speaking, my mother telling one of my aunts to come up tonight” (p. 617) and voices that “sounded like a bunch of women talking together, just a lot of women chattering” (p. 622). Participants also heard multiple simultaneous voices, including “something like a crowd” (p. 640) and “a lot of people shouting at me” (p. 630). Reports of speech directed at the person were rarer, although still present. For example, one participant reported that “Someone is telling me to stay still” (p. 628).

Such AHs have commonality with the musical hallucinations, elemental sounds, and crowds of simultaneous voices found to co-occur with more complex AVHs in schizophrenia.<sup>36</sup> The phenomenology of these AHs can be seen to be consistent with what has been termed<sup>36</sup> a “random and quasi-ictal explanation” (p. 187). However, the ability of most bottom-up neurological models to account for the more typical phenomenological aspects of AVHs, such as voices directed at the hearer and focused on everyday activities, is less successful. For example, David and colleagues have proposed that AVHs result from language input processes in the temporal lobe functioning hyperactively leading to a strong perceptual representation of auditory images.<sup>22</sup> Such a model can account well for some phenomenological properties of AVHs, such as their involuntariness, which many patients with AVHs highlight as important in differentiating their AVHs from their everyday thoughts,<sup>49</sup> their intermittent occurrence, and their perceptual qualities. This model can also be seen to account for AVHs involving verbatim traumatic memories. Furthermore, such a model also predicts patterns of activation during AVHs found in many neuroimaging studies.<sup>57</sup> However, it gives no clear reason why many AVHs tend to be focused on everyday activities, and directed at the voice-hearer. Furthermore, such a model would also appear to predict that content of AVHs should be highly repetitive. This is the case in some, but by no means all AVHs.<sup>36</sup> However, a bottom-up neurological model that makes more specific predictions about the phenomenology of AVHs has recently been developed.

Hoffman<sup>55</sup> proposes that a lack of social contact may result in deafferentation-like reorganization in regions of association cortex leading to AVHs, in a way analogous to the complex visual hallucinations in Charles Bonnet Syndrome which result from deafferentation due to vision loss. Specifically, Hoffman argues that as a result

of social isolation, language detection systems’ ability to detect complex verbal meaning is increased in response to the deprivation of normal conversational interaction, resulting in the production of spurious auditory experiences. This functions “in the service of filling in the ‘blank slate’ due to withdrawal from the world”<sup>49</sup> (p. 1172). Such a model is claimed to predict the personal relations many individual have with their voices. Hoffman<sup>58</sup> also claims such a model would predict AVHs to involve spurious social meaning in the form of complex, emotionally compelling voices of other persons or agents. This account also appears to predict that the emotional valence of the voice, and its pragmatics, would be in accordance with the way the individual relates to people within their social environment. This proposal appears to be empirically supported.<sup>59</sup> However, such a model still appears to fail to explain the tendency for AVHs to be associated with action regulation, and is hard pressed to explain the phenomenological findings of discussed above, that highlight the similarity between thoughts and some AVHs.

### Separate Phenomenologies, Separate Causes?

From the above argument-from-phenomenology it appears that each of the cognitive models reviewed are only able to presently account for a subset of AVHs. One possible conclusion is that neither of these models is correct, and that the true mechanism underlying AVHs is not readily captured by any cognitive model because at a neurological level the mechanism cuts across many cognitive, metacognitive, linguistic and/or perceptual capacities. An alternative conclusion is that both are correct, and that different types of AVHs have different underlying neurocognitive mechanisms. Such a proposal would entail subcategorizations of AVHs. The first type of AVH would be that with content directly linked to intrusive memories of, for example, abuse/trauma, which could be understood via a neurocognitive model that sees AVHs as a failure to inhibit memories. A second type would involve seemingly random auditions, such as those involving crowds, noises, and music, and could be seen as best explained at the neurological level, using an ictal, bottom-up neurological model. Finally, a class of AVHs typified by novel statements that attempt to regulate the actions of the voice-hearer, linked to their ongoing activities, and which cannot be linked directly to a verbatim memory, can be delineated. Such AVHs appear to be phenomenologically best accounted for by a neurocognitive inner speech-based model.

The proposal that subcategorizations of AVHs are necessary, each involving different underlying neurocognitive mechanisms, leads to a number of falsifiable hypotheses. Firstly, different patterns of neural activation would be likely to underlie these different forms of AVHs. For example, a patient with an AVH identifiable

as a verbatim memory of abuse would be hypothesized to show a different pattern of neural activation to a patient with a more novel AVH commenting on on-going actions. The first type of AVH may show activation more similar to that seen during traumatic autobiographical memory recall. As Broca's area activation decreases during recall of traumatic (as compared to neutral) memories in patients with PTSD<sup>60</sup>, and increases during inner speech production,<sup>43</sup> less activation should be seen in this area during AVHs involving intrusive memories of abuse, than during AVHs involving novel comments on ongoing actions. This proposal may explain the inconsistent findings of studies of activation in Broca's area during AVHs.<sup>8</sup> Such inconsistency may be due to such studies involving differing ratios of patients with AVHs associated with intrusive memories of trauma/abuse to patients with more novel AVHs. It is, however, also highly possible that the inconsistent finding of Broca's area activation may be due to the different tasks or paradigms that have been used. To allow comparability of findings it may be valuable for neuroimaging studies in future to report more details on the specific phenomenology of their patient's AVHs, and to analyze their data by sub-groups of hallucinators based on phenomenology.

The distinction between inner speech-based AVHs and memory-based AVHs should also lead to detectable electrophysiological differences between such AVHs. Electrophysiological studies have found some evidence that when inner speech is produced in those with AVHs, dampening of the activity of the auditory cortex is impaired.<sup>61</sup> It can be hypothesized that such a relation should be found only in AVHs which are phenomenologically consistent with inner speech. Conversely, in those which are more phenomenologically consistent with verbatim intrusions from memory such a disconnection would not be predicted. Again, the failure to employ such a distinction, and to hence treat AVHs as a homogeneous phenomenon, may explain the mixed findings that electrophysiological studies have reported to date in investigating dampening of auditory responses in those with AVHs.<sup>61</sup>

One factor that is likely to complicate testing such hypotheses is the fact that phenomenologically different types of AVHs often co-occur. For example, AVHs with parallels to inner speech often occur in the presence of seemingly more ictal-based AHs, such as environmental noises. This is suggestive that there may indeed be an underlying neurological mechanism which cuts through across many cognitive, metacognitive, linguistic and/or perceptual capacities. Another factor to consider is that, although this paper has contrasted a AVHs-as-memories model with inner speech-based models, these two models may, to some degree overlap. The concept of a dynamic developmental progression, which I turn to next, helps illustrate this point.

### Dynamic Developmental Progression

AVHs tend to evolve over time<sup>36</sup> with voices "fashioning increasingly detailed dialogues with or about the patient" (p. 187). The evolution of AVHs and AHs over time, which is currently a neglected and poorly understood area, I term their *dynamic developmental progression* (DDP). This can be applied to the change in the nature of the AVHs/AHs themselves, as well as the change in the distress associated with them, and the beliefs held about them. As detailed published accounts of the DDP of AVHs are rare, an example from personal experience will be given. Adam (not their real name), who had been diagnosed with schizophrenia, initially developed an AVH the content of which was a voice saying (verbatim) phrases which had actually been said to them during a traumatic event. However, over time Adam's AVH changed to become the voice of the same individual (from the traumatic event) but now saying novel things. It is hence worth considering the possibility that the mechanisms that may form the original basis for an AVH (e.g., a verbal intrusion of a specific memory of trauma) may come, over time, to be developed into a form unpredictable from its original content and potentially underpinned by different mechanisms (such as inner speech). Such transformations may be the result of cognitive, emotional, and neurological mechanisms. In the example above, it may be that memory-based and inner speech-based processes interacted. Extensive activation of temporal lobe structures during spontaneous verbal thought has been taken to suggest that long-term memory processes may form the core of spontaneous thought.<sup>62</sup> Hence, if hyperaccessible memories exist (e.g. traumatic memories), it is plausible that these will be employed in inner speech processes. This could lead to cognitions with the properties of inner speech (e.g., action focused, relevant to ongoing events etc) but with content drawn from such memories. Such an interaction may result in an AVH involving a novel, action-related cognition involving the voice of an abuser. Although speculative, this highlights the possibility of synthesizing AVH-as-memories models with inner speech-based models, to develop a synergistic account in-line with a wider range of aspects of the phenomenology of AVHs than either of the models alone.

The concept of a DDP may prove valuable in a number of other ways. Given that the experience of AVHs stretches into the healthy population, it may be fruitful to consider how (and to what degree) AVHs may evolve from brief, benign experiences that can be considered more or less normal, to a distressing clinically relevant experience.<sup>35</sup> One possible DDP is that patients who come to develop schizophrenia initially experience benign, non-clinically relevant AVHs the content of which then becomes negative and distressing as a result of a traumatic/abusive experience. Personal experience indicates

that a number of patients with schizophrenia report a DDP involving a positive, helpful voice in childhood which, after the individuals were exposed to a range of highly abusive experiences, became negative, abusive and entrenched in adulthood. Another (related) possibility is AVHs with benign content come to be negative, due to broader psychosocial factors affecting the individual. For example, how the individual relates to others in their social world, their social rank and levels of powerlessness, are associated with their relation to their AVHs.<sup>59</sup> It has also been noted<sup>39</sup> that some AVHs follow a DDP in which they “first appear as the ordinary dream; then they appear in the hypnagogic state; then finally in the full waking state”, a famous example being Emanuel Swedenborg.<sup>63</sup> A range of other DDPs are possible and encountered in patients, and it is likely that a large range of factors may interact dynamically to result in AVHs that are all-consuming and fiercely destructive. Phenomenological surveys which tend to take a ‘snapshot in time’ of individual’s AVHs, without assessing in detail the DDP of such experiences, are poorly equipped to address such issues. This highlights the need for future studies of the DDP of AVHs and AHs.

## Conclusions

A key challenge for the study of AVHs is to derive models that fit the phenomenology of the experience, rather than fitting models to a phenomenology that does not pertain to it.<sup>64</sup> This paper has observed that although models are created to fit the phenomenology of AVHs, due to the diverse nature of the experience they inevitably end up only fitting specific types of AVHs. Whilst it is possible a grand unified theory of AVHs and AHs may be developed, possibly involving a neurological mechanism cutting across many cognitive, metacognitive, linguistic and/or perceptual capacities, at present no such model exists. In contrast, I have proposed that to honor the phenomenological diversity of the experience of AVHs, a fruitful strategy may be subcategorization. If phenomenology can indeed give clues to the etiology of the experience<sup>4</sup>, then each subcategory may be accounted for by a different model involving different neurocognitive processes.

Specifically, it has been argued that neurocognitive intrusive memory-based models of AVHs account well for AVHs that have content directly linked to verbalizations during and surrounding earlier traumatic experiences. Purely bottom-up ictal neurological models have been argued to fit other specific AHs, such as those involving crowds, noises, music, and brief stereotyped phrases. Finally, inner speech-based models have been proposed to underpin the typical form of AVHs, involving the regulation of everyday activities, which are engaged in the apprehension of objective reality, and have the same dialogical structures found in ordinary speech. A number

of empirical tests have been suggested to test the proposal that subcategorizations of AVH exist that are underpinned by different neurocognitive mechanisms. If correct, this highlights the potential for future research designs to not just to contain groups of ‘hallucinators’ and ‘non-hallucinators’, but to group individuals with AVHs according to phenomenological subcategorizations.

I have also highlighted the need to study the dynamic developmental progression of AVHs, and how such an analysis opens up the possibility of synthesizing memory- and inner speech-based models of AVHs. Future work along these lines would likely benefit our understanding of the causes of AVHs.

If the proposal of subcategorization of AVHs, underpinned by different mechanisms, can be empirically supported, this would importantly also have clear implications for treatment. For example, some therapeutic strategies aim to get voice-hearers to engage in dialogues with their AVHs, in an attempt to alter the individual’s relationship with their voices.<sup>38</sup> Such an approach may be less appropriate for voices that are the result of intrusive memories, or bottom-up neurological factors, with instead techniques suitable to PTSD type flashbacks being more appropriate. The reverse would be the case for those with a phenomenology similar to inner speech. Also, given that up to a quarter of patients experience persistent hallucinations that are resistant to medication<sup>65</sup> it may be fruitful to investigate whether the different phenomenological subcategorizations of AVHs proposed here respond differentially to antipsychotic medication.

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