

A Look at Auditory Hallucinations: Do You Hear What I Hear?

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Abstract:

This paper looks at what an auditory hallucination is. The main part deals with looking at the difference between psychotic (Schizophrenics) individual and non-psychotic individuals with respect to experiencing auditory hallucination. The research that has been conducted within the scope of auditory hallucinations has a dividing line between verbal auditory hallucinations, which occurs mostly among Schizophrenics, and musical hallucinations, which occurs more so with non-psychotics and not as frequently with Schizophrenics. The paper also looks at anatomical locations that are activated and deactivated throughout the brain. Finally, a discussion about other auditory phenomena that occur that are not classified as being auditory hallucinations.

Introduction

What are hallucinations? More specifically what are auditory hallucination? Some say that these are “internal mental events, such as cognitions, which are perceived by the individual to be of a non-self origin” (Stinson et. al, 2009). All that this means, is that a person has some non-stimulated sound represented in their head. They could be sitting in a quiet place, and all of a sudden start to hear something that is not present to them. These can come in different forms, such as verbal (person talking), musical and non-sensical (just noise). Oliver Sacks (2007) talks mainly about his interactions with people and auditory hallucinations, mainly musical ones.

Sacks has multiple accounts of musical hallucinations documented in his research. In his book *Musicophilia* (2007), Sacks accounts for people without psychotic conditions experiencing auditory hallucinations. But, is there a divide between people with psychotic disorders (such as Schizophrenia) and people without psychotic disorders with respects to experiencing auditory hallucinations? This will be explored. T.D. Griffiths (2000) talks about people experiencing auditory hallucinations with the onset of deafness.

This brings up the question, is there something more to experiencing spontaneous auditory hallucinations then we think? Are there similarities between a person with psychosis experiencing the hallucination and a person who does not have psychosis, or not? The present paper will bring up these issues and examine certain aspects of these auditory hallucinations.

The first section in the paper will give an overview of what a hallucination is, and distinguish between different types of hallucinations. The next two sections in the paper will give a broad overview of what an auditory hallucination is as well as what a musical hallucination is. This will define what it is and some nomenclature (Blom & Sommer, 2003) associated with auditory hallucinations.

The next two sections will deal with the psychotic disorder of Schizophrenia, and how one with

Schizophrenia experiences auditory hallucinations, as well as classifying auditory hallucinations between Schizophrenics and non-Schizophrenics. These sections will aid in setting a ground for the difference between psychotic persons and non-psychotic persons.

The next two sections will deal with what causes an auditory hallucination, if there are any, as well as what happens when a person experiences an auditory hallucination. One study looked at certain triggers of auditory hallucinations (Stinson et. al, 2009). This section will focus mainly on studies done assessing people with auditory hallucinations.

Two more sections will deal with areas in the brain that associated with auditory hallucinations, and other auditory-like conditions that are not considered auditory hallucinations. The brain area section will deal with research done using brain scanning techniques trying to see what areas in the brain are activated when an auditory hallucination occurs (Diederer et. al, 2010). As for the auditory-like conditions that are not considered auditory hallucinations, earworms and the like will be looked at (Levitin, 2007).

What is a Hallucination?

Hallucinations can come in many different forms affecting part of one's senses. That is, hallucinating visually, auditorily, olfactory, gustatorily, or cutaneously (Chen E. & Berrios G.E., 1996). According to studies done with looking at the two most common hallucinations, visual and auditory, there are distinct differences in how people behave in everyday life (Delespaul, P., deVries, M., & van Os, J., 2002).

The study done by Delespaul et. al., found that the context that either an auditory or visual hallucination occur determines the intensity of the episode. The researchers found that the difference between static and non-static activities led to an increase or decrease in intensity of hallucinations.

When a person was doing something non-static, such as an active engaging activity, this led to a decrease in intensity for auditory hallucinations, but not visual hallucinations. The opposite was true for static activities, such as a passive activity. Also, social withdrawal led to decreased intensities for auditory but social engagement led to decreases in intensity for visual hallucinations (2002). The context of the situation leads to how one perceives the hallucination, and how intensive the hallucination can be. The authors also noted that auditory and visual hallucinations occur most frequently among schizophrenics, and less frequently among non-schizophrenics.

Olfaction deals with the sense of smell, and an olfactory hallucination is Phantosmia (Franselli, J. et. al., 2004). This olfactory hallucination is when a person smells something that is not currently a present stimulus. An example of a cutaneous, skin sense, hallucination could be when a person feels a cell phone vibrate in their pocket (Braguglia K.H, 2008). The last hallucination is gustatory, which is the taste sense. This is when a person thinks they are tasting something, when there actually is not stimulus present (Barker, P., 1997).

With all of the different hallucinations present, only auditory hallucinations will be talked about in this paper. Auditory hallucinations are discussed within the realm of Cognitive Science and Psychology, and are very interesting to make claims about. The first item to address is defining and discussing what an auditory hallucination is.

What are Auditory Hallucinations?

The best definition for an auditory hallucination found throughout the literature is “A clear consensus has developed that auditory hallucinations are internal mental events, such as cognitions, which are perceived by the individual to be of a non-self origin” (Stinson et. al., 2009). This just means that the auditory hallucination is being presented to a person, without an outside stimulus affecting that

person. This study's main question looked at experimentally investigating the role of thoughts in triggering auditory hallucinations.

Stinson et. al., found that the participants in their study were able to detect antecedents to when an auditory hallucination was going to present itself, but the study was not able to say that these antecedents were the true cause of the auditory hallucination (2009). This should make one think, could one possible reason be that there are hallucinations causing the hallucination? The researchers then used a virtual reality system to test this, and found that different people hearing voices might be using a different voice recognition pathways in their brain (Stinson et. al., 2009). The researchers also found that the people who heard voices outside the virtual reality, heard the same amount inside the virtual reality setting (Stinson, et. al., 2009).

Another study suggests that auditory hallucinations are experienced as being real, and cover a range of experiences (Hugdahl, K., 2009). Just like the previous study, Hugdahl states that auditory hallucinations are defining points of Schizophrenia, but that they can also occur in non-Schizophrenics as well (2009). More about Schizophrenia and auditory hallucinations will be discussed later. The defining factor of the Hugdahl study deals with seeing auditory hallucinations driven by bottom-up processes. Bottom-up processes have no prior stimulus to aid in recognizing something, the stimulus is presented for the first time. Top-down processing is when a primer is presented then the experiencing of a stimulus stimulus occurs (2009). When there is a failure in the top-down processing, there is no way to inhibit the bottom-up processes, in turn having the person with Schizophrenia not be able to control the "voices" they are hearing (see fig. 1) (Hugdahl, K., 2009).

Hugdahl suggests that there are two main explanations of what auditory hallucinations are. The first model is that there is inner speech, or talking to oneself. But, the only shortcoming of this is that most people say that they are not talking, but some other voice is talking in their head. To better refine this, Hugdahl says is more inner hearing, rather than inner speech. The other model is the experience of

a traumatic memory surfacing (2009). This study also found another defining factor of auditory hallucinations is that people say that the voices they hear are from within, rather than from an external source. This study also defined auditory hallucinations as those that are verbal in nature, rather than any other type of auditory hearings. This discounts musical hallucinations, which will be looked at next.

What are Musical Hallucinations?

Oliver Sacks has done much research on the topic of musical hallucinations and what they actually are. To quote from Sacks' book *Musicophilia*, “Mrs. C. was now finding that though certain tunes seemed to repeat themselves at random, suggestion and environment and context play an increasing part in stimulating or shaping her hallucinations. ... After baking a French apple cake, she hallucinated bits of 'Frere Jacques' the next day” (Sacks O., 2007). This is consistent with the idea that context plays a role at some level when it comes to a person experiencing an auditory musical hallucination.

One may be asking, is really intensive musical imagery just a musical hallucination? The answer is no, there is more and something different going on when one experiences a musical hallucination over just musical imagery. Sacks' quotes “Musical hallucinations can be very loud and interfere with perception or conversation in a manner that never occurs with normal musical imagery” (2006). We all experience the “music in our head” phenomena at some point in life. The idea of earworms, which will be discussed later, are exactly that. But Sacks put musical hallucinations in another light too. “Unlike these earworms, true musical hallucinations are experienced by those who have them as unprecedented and deeply disquieting. There is insufficient awareness among physicians of musical hallucinations, in part because patients are reluctant to report them, fearing that they will be dismissed or seen as ‘crazy’” (Sacks O., 2006). Everyone does not experience this, and there has to be a distinction between

the two.

Sacks make a distinction that among onset of deafness community, musical hallucinations are common. Found most common among elderly people, these hallucinations are very vivid and the descriptions that Sacks has encountered are very colorful. Sacks believes that musical hallucinations are by far the most common non-psychotic hallucination (Sacks O., 2006). To quote Sacks, “But musical hallucinations are surprisingly common, affecting at least 2% of those who are losing their hearing, as well as patients with a variety of other conditions” (Sacks, O., 2006). This may seem like not a lot of people who are going deaf experience musical hallucinations, but it is, and it is a statistic that should not be over looked.

T.D. Griffiths researched how the onset of deafness led to musical hallucinations (2000). What Griffiths was trying to accomplish in this study was that of building a model showing how these types of hallucinations were brought upon by the onset of deafness. The study showed that there were specific triggers of brain activity in the temporal lobe causing the musical hallucinations. This was due to the fact that since there was impoverishment (deafness) of activity, the brain tried to “make-up” for it by filling in the gaps. Hence, the musical hallucinations occurred.

What is Schizophrenia?

Schizophrenia is a psychotic disorder that alters brain processes associated with perception. A well defined definition of Schizophrenia is “...a psychiatric disorder that alters different psychopathological spheres: cognition thought and affect. Emotional deficits have been considered part of schizophrenia since the early descriptions” (Escartí, M., 2010). Many people who suffer from Schizophrenia experience hallucinations of two sorts, usually. The first is visual hallucination and the other is auditory hallucinations, as described above.

Another approach to Schizophrenia comes from a study done by Hoffman and McGlashan (2007). They stated that Schizophrenia is a devastating disorder that produces delusions and hallucinations, as well as cognitive deficits. It has been said that it only affects a small population of people, but the symptoms are common throughout this small group (Hoffman, R., & McGlashan, T., 2007). Schizophrenia is said to start between 18 and 25 for males; 20 to 30 for females, thus, researchers deeming it a neurodevelopmental disorder (Hoffman, R., & McGlashan, T., 2007). This should be very daunting when thinking about how long a person has been alive for. But, there needs to be some emotional trigger that occurs during development for a person to start showing signs of Schizophrenia.

Auditory hallucinations are said to be present among 50% to 80% of people with Schizophrenia (Hoffman, R., & McGlashan, T., 2007). These are staggering percentages to look at from an outsider looking in. This means, that 5 to 8 Schizophrenics out of 10 experience auditory hallucinations. So, when a Schizophrenic experiences an auditory hallucination, there has to be something going on in the brain that is different than a non-Schizophrenic. The classification of auditory hallucinations must differ from Schizophrenics to non-Schizophrenics. This next section deals with this exact problem.

Classifying Hallucinations: Schizophrenic versus Non-Schizophrenic

Hugdahl suggests that there is a difference between people with Schizophrenia and people without. He says that people who are non-Schizophrenic can still hear voices, but not in the same way that Schizophrenics experience hearing voices. The reason is, that people without Schizophrenia have intact prefrontal and temporal lobes, which lead them to believe that the voices can be lessened or even taken away. This is not the case with Schizophrenics. Hugdahl also says that since people with Schizophrenia are damaged in both top-down and bottom-up processing methods the voices are almost

deemed “uncontrollable” (Hugdahl K., 2009). The study also stated that when non-Schizophrenics experience the voices, the reason they can control (inhibit) them is because their bottom-up processing is impaired, but their top-down is still intact. This is one take; another take by Sacks deals with musical hallucinations in non-psychotic individuals.

Sacks describes, in one study, that non-psychotic individuals can experience auditory hallucinations, but in a different manner than psychotic individuals. To quote from Sacks, “Yet deafness almost never leads to hallucinations of voices, only to hallucinations of music (voices may be heard in the words of a lyric, but not muttering or talking). That musical hallucinations thus take precedence over all other auditory hallucinations shows again the special and potent character of the neural processing of music” (Sacks, 2006).

By looking at these two different accounts, one reason could be that musical hallucinations are breakdowns in bottom-up processing. Sacks, on many accounts, has said that when a person experiences an auditory hallucination, there is usually something else going on that causes it to occur, mainly the onset of deafness (Sacks, O., 2006 & Sacks, O., 2007). Thus, there must be something more than just a classification of the two different hallucinations. It has to be in how a person is experiencing the hallucinations.

Experiencing Auditory Hallucinations

There was a study done assessing what happened when a person with Schizophrenia experiences a musical hallucination. Baba et. al. described what happens when a Schizophrenic experiences a musical hallucination (2003). The authors' even stated that musical hallucinations are not that common among Schizophrenics, so this is consistent with evidence presented in the previous section. Unlike non-Schizophrenics, Schizophrenics experience musical hallucinations in three stages.

The three stages that Schizophrenics experience musical hallucination are as follows. The first stage deals with intense sensory quality and clarity, which leads to repetitive behavior, such as obsessive-compulsive disorder. The second stage deals with words being associated with music and a less subjective feeling, and more of another voice being present. The last stage deals with the invasiveness of the hallucination (Baba, A., Hamada, H., & Kocha, H., 2003). All of this just means that the hallucinations come to the surface of a patients consciousness unwillingly. The authors also noted that the sequence of stages is not linear, and that the stages can jump from one to three, or just be limited to stages one and three.

This account is a similarity of musical hallucinations among psychotic individuals. Here is an account of how a person with Schizophrenia experiences auditory, non-musical, hallucinations. As stated earlier, Hugdahl showed that there were breakdowns in the interactions between top-down and bottom-up processing among Schizophrenics (Hugdahl, K., 2009). This is interesting to look at because a Schizophrenic hears voices, but at a level a non-psychotic can not imagine. When a non-psychotic individual experiences a hallucination they know that it will soon pass by and that it is just a hallucination. Whereas, a person with Schizophrenia can let the voices lead their daily lives, because there is nothing inhibiting the voices from not doing this.

Areas in the Brain Associated with Auditory Hallucinations

The main, and most notable, area that is associated with auditory hallucinations is the temporal lobe (Loo, C., 2010). This is not the only place in the brain that deals with auditory hallucinations, but it is most prominent. Another area that is seen throughout the literature on auditory hallucinations is within the limbic system, especially the amygdala and hippocampus (Escartí, M. et. al., 2010).

Two different studies show information pertaining to the parahippocampal gyrus, among

Schizophrenics. One study having increased activity in the parahippocampal gyrus during an auditory hallucination (Escartí, M. et al., 2010) and another study showing the parahippocampal gyrus becomes deactivated after the hallucination has occurred (Diederer, K. et al., 2010). Both of these studies said that the parahippocampal gyrus deals with memory recollection, which is said to be used as a doorway to the hippocampus for recognition. How one can interpret this information is by looking at auditory hallucinations as being traumatic memories that constantly get brought up, but come in different forms because they are not being recognized, or are being recognized incorrectly.

There are other areas that showed activation during an auditory hallucination. These areas were mainly in the language areas of the brain, left superior temporal lobe (Broca's and Wernicke's areas) (Diederer, K. et al., 2010). These areas make sense because this is where the voices are being processed through, when a person “hears” them. Depending on whether or not a person can understand what was being said dealt with which area in the language center of the brain was being activated more.

Other Auditory Phenomena – That Aren't Auditory Hallucinations

Ever wonder why a catchy tune gets “stuck” inside your head? “All of us have experienced the involuntary, helpless mental replaying of songs or tunes, or snatches of music we have just been exposed to, by chance, even, perhaps, without ‘listening’ consciously. We call such tunes ‘catchy’—and they are sometimes referred to as ‘earworms,’ for they may burrow into us, entrench themselves and then perseverate internally hundreds of times a day, only to evaporate, fade away, in a day or two, perhaps to be followed by the next earworm” (Sacks O., 2006). Sacks says that these simple comings and goings of catchy tunes are not auditory or musical hallucinations, but rather when they developed into something more, that they start to become classified as hallucinations.

Daniel Levitin also brings up in his book *This is Your Brain on Music* (2007) the idea of

earworms also. Levitin suggests that the only way to get rid of an earworm is to break some threshold to dissipate it. How? By having another earworm pop into one's head usually is the trick. This might seem like a never ending cycle of earworm after earworm, but this is not the case. Usually other, more important things, such as a someone diverting your attention to them or dodging an animal that ran in front of your car. Eventually, like hiccups for example, they go away.

Levitin points out a specific reason for earworms could have been evolution. They could have been useful for courtship, or other rituals a culture might have. But to us now, they are just annoying sappy musical phrases that distract us.

Conclusion

With looking at evidence of auditory hallucinations in both psychotic and non-psychotic people there should be some conclusions made. Just because a person experiences an auditory hallucination does not mean they are psychotic or are going to become psychotic. Even though some people think they are and avoid letting others know in fear of being called 'crazy' (Sacks O. 2007). Auditory hallucinations are fascinating and also very mysterious. Some researchers consider just verbal auditory hallucinations as being suspect to psychosis (Hugdahl K., 2009), where others found that different types of hallucinations, musical ones, can crop up in psychotics (Baba, A. et. al., 2003).

By looking at all of this evidence, one should feel comfortable to say that both psychotics and non-psychotics can experience hallucinations, but in varying ways. Mainly, psychosis leans towards a failure of both top-down and bottom-up processing leading to hearing voices. Whereas, on the other hand for non-psychotics this is not the case. Usually when a non-psychotic experiences an auditory hallucination there is something going wrong within the framework of the mind, such as the onset of deafness. The loss of hearing can lead people to try and “fill in the holes” where they use to hear things,

thus a hallucination can occur (Sacks O., 2006 & Sacks, O., 2007). This is one defining difference between psychotics and non-psychotics when it comes to auditory hallucinations. There are other distinct differences, as noted in the paper, between the two, but auditory hallucinations do occur among both populations.

Appendix

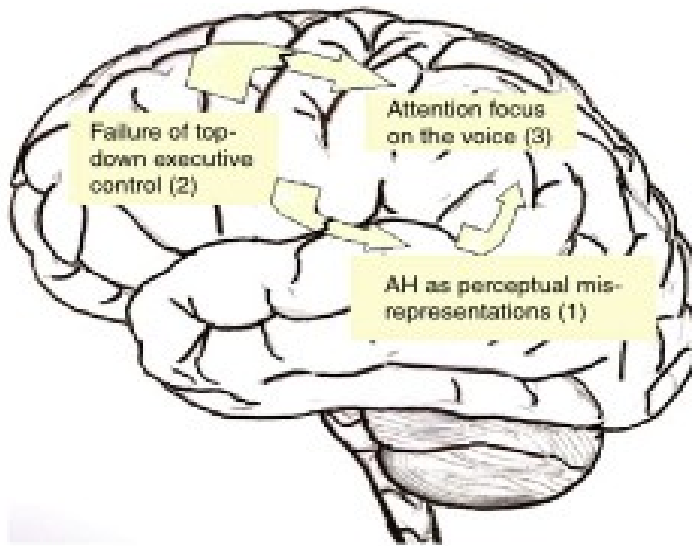


Fig. 1, the breakdown of top-down and bottom-up processes among Schizophrenics.

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