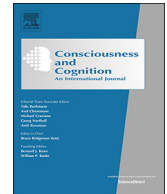




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## Musical hallucinations, musical imagery, and earworms: A new phenomenological survey

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### ABSTRACT

Musical hallucinations (MH) account for a significant proportion of auditory hallucinations, but there is a relative lack of research into their phenomenology. In contrast, much research has focused on other forms of internally generated musical experience, such as earworms (involuntary and repetitive inner music), showing that they can vary in perceived control, repetitiveness, and in their effect on mood. We conducted a large online survey ( $N = 270$ ), including 44 participants with MH, asking participants to rate imagery, earworms, or MH on several variables. MH were reported as occurring less frequently, with less controllability, less lyrical content, and lower familiarity, than other forms of inner music. MH were also less likely to be reported by participants with higher levels of musical expertise. The findings are outlined in relation to other forms of hallucinatory experience and inner music, and their implications for psychological models of hallucinations discussed.

### 1. Introduction

Auditory hallucinations (AH) are defined as the conscious experience of sounds that occur in the absence of any actual sensory input. Although the most frequently reported form of AH are auditory verbal hallucinations (AVH), phenomenological surveys have also shown that a substantial minority of people also report musical hallucinations (MH): that is, the perception of music when none is playing. For example, one survey of 100 people with psychosis and AVH found that 36% also described the occurrence of MH (Nayani & David, 1996). The most frequent reports were of hearing choral music, with orchestral music and pop music also evidenced, although specific frequencies were not provided. More recently, McCarthy-Jones et al. (2012) analyzed data from a semi-structured interview with 199 psychotic patients who reported AVH, finding that a smaller proportion (compared to Nayani and David) of approximately 15% also experienced MH. The two largest phenomenological surveys of AVH, then, suggest that MH occur in a substantial minority of people who hear voices; however, since both primarily focus on AVH, few details of MH are described beyond prevalence. Whilst questionnaire measures used to assess proneness to hallucinations (e.g., Launay-Slade Hallucination Scale; Morrison, Wells, & Nothard, 2000) in the general population do include items relating to non-verbal hallucinations, responses to individual items are rarely reported; thus, we know little about either the prevalence or phenomenology of MH in clinical or non-clinical samples. Indeed, non-verbal hallucinations have been somewhat neglected in the psychological literature, with only a small number of studies investigating risk factors and basic phenomenological features of MH.

Surveys focusing exclusively on MH have suggested that they may occur in around 16% of individuals with a diagnosis of

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schizophrenia (Saba & Keshavan, 1997), and as many as 41% of individuals with obsessive compulsive disorder (Hermesh et al., 2004). Other risk factors include hearing impairments, old age, and social isolation, although these may not be independent factors (Evers & Ellger, 2004). Few surveys have specifically investigated the phenomenology of MH, further than reporting the most frequent styles of music. Saba and Keshavan did report on several details of MH in a small sample of individuals with a diagnosis of schizophrenia, showing that the majority included both instrumental and lyrical elements, which tended to be familiar to the individual. Patients tended to appraise the MH fairly positively, with the most frequent description of the experience being ‘soothing’ (62%). Many experiences of MH were described as perceived as emanating from the external environment, and approximately half were described as outside of volitional control, which Saba and Keshavan argue should be considered a key feature of MH. Whilst this study provided important information on the experience of MH in schizophrenia, the sample size (16 participants reporting MH) was low, and the questions on phenomenology relatively limited.

Golden and Josephs (2015) recently reviewed medical records of individuals, including 393 cases of MH, grouping the data into five categories: MH associated with neurological disorder, psychiatric disorder, structural brain damage, drug toxicity, and those not otherwise classifiable. The study mainly reports on brain regions associated with MH, but does note that many individuals with psychiatric disorders found that the experiences were ‘mood-congruent’ (e.g., sad music when they were feeling depressed). Indeed, within psychiatric patients reporting MH, depression seems to be the most common diagnosis (69%), along with hearing loss or tinnitus (Golden & Josephs, 2015; Rocha et al., 2015; Teunisse & Olde-Rikkert, 2012). A case series presented by Warner and Aziz (2005) of patients referred to old-age psychiatric services, though, only found a rate of hearing loss of 33% in patients with MH – perhaps surprisingly low given a mean age of 78 years. They also note that many patients were not distressed by the MH, and so speculate that the prevalence of such phenomena may be higher than previously thought if individuals do not seek medical attention. Due to the nature of these studies, however, no participants from non-clinical populations were included. Other studies have also used stringent inclusion criteria: for example, Evers and Ellger, in a review of the etiology of MH, deliberately excluded musical ‘pseudohallucinations’ (those experienced as internal to the individual). The distinction between ‘true’ hallucinations and pseudohallucinations is no longer thought to be clinically significant (Copolov, Trauer, & Mackinnon, 2004), and research into AVHs typically includes both internally and externally located perceptions (Nayani & David, 1996). It is unclear to what extent MH are experienced as internal or external, but it is possible that previous research has omitted a significant number of cases by using overly strict inclusion criteria.

Furthermore, it is unclear to what extent the attributes assessed in the small amount of previous research could also be applied to other forms of ‘inner music’<sup>1</sup> (Ferynhough, 2016, p. 238). Musical imagery, for example, is the generation of music in one’s own head, not necessarily instigated by any external percept. It is frequently reported by many individuals in the general population (Bailes, 2007; Williamson et al., 2012), and often used by musicians to rehearse or aid reproduction of music, in the form of notational audiation (Brodsky, Henik, Rubinstein, & Zorman, 2003). Musical imagery can also occur involuntarily (INMI) with little or no volitional control. One form of INMI, ‘earworms’ (also referred to as ‘sticky tunes’ or ‘stuck songs’), are typically defined by their repetitiveness and persistence (although there is some debate in the literature regarding how to precisely define the experience – see below). Previous research has indicated that the frequency of earworms is affected by exposure to, and rehearsal of, music (Liikkanen, 2012), and as such is elevated in musically trained individuals (Beaty et al., 2013; Floridou, Williamson, Stewart, & Müllensiefen, 2015), with one experience sampling study in musicians finding musical imagery occurring in as many as 32% of randomly sampled episodes, with 58% of these samples noted as being due to having recently heard or rehearsed music (2007; Bailes, 2006). Earworms tend not to be associated with negative emotions, unless the reported duration is particularly lengthy (presumably due to unwanted persistence) (Floridou et al., 2015).

To our knowledge, no research has directly compared self-reported experiences of musical imagery and earworms to MH, and, in fact, the boundary between earworms and MH is somewhat unclear in much of the literature. For example, Hemming (cited in Williams, 2015) defines MH as INMI that reaches a pathological level (presumably reflected in distress experienced by the individual), implying that MH are simply a more extreme, persistent, or distressing version of earworms. In support of this, the aforementioned study by Saba and Keshavan (1997) distinguished MH from musical imagery purely in terms of volitional control. In contrast, Williams argues that whilst both MH and earworms are involuntary, only MH are experienced as located in the external environment. However, as discussed above, other forms of auditory hallucination, for example AVH, are often experienced as internally located (Daalman et al., 2011; Nayani & David, 1996), yet are typically still classified as hallucinatory experiences. An open question, then, is the extent to which earworms and MH share phenomenological attributes (e.g., control, perceived location), and whether MH can be distinguished on other aspects of musical experience (e.g., type of music, frequency, duration, familiarity, level of acoustic detail).

Research into musical imagery and earworms has also investigated their effect on mood and behavior, but again, these have not been directly investigated in comparison to MH. For example, Williamson, Liikkanen, Jakubowski, and Stewart (2014) showed that 74.6% of individuals reported humming or singing along in response to earworms, whilst only 10.9% reported attempting to suppress them. Participants in other studies have also reported that bodily movements in response to earworms (e.g., tapping a foot to the beat) are relatively common (Floridou et al., 2015). Finally, frequency of earworms was associated with self-reported obsessive-compulsive traits, perhaps similarly to the persistence of intrusive thoughts in obsessive-compulsive disorder (Beaman & Williams, 2010). In contrast, little is known about typical affective and behavioral responses to MH.

<sup>1</sup> In this paper, the term ‘inner music’ will be used as an umbrella term, to refer to all forms of self-generated, internal musical experience (e.g., musical imagery, earworms, musical hallucinations).

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