

# New Directions for Understanding Involuntary Musical Imagery

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## ABSTRACT

This paper addresses the state of art in the studies of involuntary musical imagery (INMI), an emerging topic in psychology. We define INMI as a private, conscious experience of reliving a musical memory without a deliberate attempt. We review the empirical literature and draw guidelines for future research on the matter. As example of a new research direction, we provide a study of how INMI relates to social interactions in everyday life based on a corpus of over one thousand open-ended survey questions.

The data shows that INMI can evoke overt behavior and have social consequences. Some people found it difficult to distinguish their overt spontaneous musical behavior from covert experiences. In response to an INMI inspired music act, many had experienced socially awkward situations or were consciously trying to avoid public musical expression. In the other end, some people choose expression and intentionally try to “pass on the earworm”, even if they expected reproach for doing so. These results suggest that INMI is an instance of “involuntary music”, sometimes associated with overt behaviors and social consequences

The next steps in the research on INMI should be targeted to understanding the psychology underlying this phenomenon more deeply and socially. Instead of characterizing the phenomenology on different levels, we should seek the causal mechanisms related to INMI, possibly on neural level and to differentiate the different components of INMI from each other and related psychological and psychopathological phenomena.

## I. INTRODUCTION

Involuntary musical imagery (INMI) refers to a private, conscious experience of reliving a musical memory without a conscious attempt. Commonly this experience involves repetition of some musical memory. Anecdotes in popular literature provide a historical record of this psychological phenomenon at least to 19<sup>th</sup> century (Twain 1876) but psychology has gotten into the topic only more recently (Bailes 2007; Beaman and Williams 2010; Halpern and Bartlett 2011; Liikkanen 2012; Williamson, Jilka *et al.* 2012). With the exception of a single book produced in the final strong tides of the psychodynamic tradition (Reik 1953), the features of involuntary music have remained unexplored until early 21<sup>st</sup> century. Some popular writers have discussed the topic (Levitin 2006; Sacks 2007), but systematic studies have been scarce.

In this paper we review the current scientific knowledge relevant to INMI, discuss the desirable directions for future research and present an example of extending the study of INMI to the direction of social life. In our empirical case, we explore two dimensions: implications and associations of INMI to overt behaviour, and involuntary music as a focal point in social life. Our motivation is to describe the possible roles of INMI in social interaction.

## II. BACKGROUND

In this section, we provide an overview of the related literature on empirical findings and theoretical musings on the topic. The focus is solely on involuntary music, leaving out the evident association of INMI with intentionally reinstated musical memories studied under the topic of *musical imagery* (e.g. Godøy and Jørgensen 2001; Halpern 1988; Halpern 2001; Zatorre, Halpern *et al.* 1996). We consider literature from three disciplines: general psychology (specifically music), clinical psychiatry and neuroscience and psychoanalysis (psychodynamic psychology).

### A. Involuntary music in mainstream psychology

For this review, we analyzed peer-reviewed journal publications across the field of psychology. The first paper on the topic came out in 2004. In a series of studies reported by Kvavilashvili and Mandler (2004), they coined the term *involuntary semantic memories*. It is a counter-part for involuntary autobiographical memories that have been studied since 1990's (e.g. Berntsen 1996). In Kvavilashvili's study, music (melodies) was included as a separate type of semantic memories along with words, phrases, names, visual images and others. It was the one with the highest probability of “mind-popping” as reported by 205 students who completed a survey. The authors observed that involuntary semantic memories had features distinct from autobiographic memories, but did not seek to differentiate between the different forms of semantic memories.

A clear challenge for studying INMI has been methodology. By using experience sampling methodology, Bailes (2006) was able to investigate involuntary music experiences *in situ* by prompting participants over a cell phone. Her study of musicology majors (Bailes 2007) revealed a high prevalence of music experienced frequently by the students. This included both rehearsed and consumed music, but also new tunes. Often the students recognized temporal associations with music processed intentionally and later occurring involuntary episodes. Beaman and Williams (2010) also utilized a similar method to study INMI. The second study they reported collected diaries from 25 people from a period of four weeks. Among the numerous INMI incidents recorded, the episodes took in average 25 min and happened over once a week. They related to a number of different songs as 74% of reports involved a unique song. This indicates minimal repetition of a single song across and within respondents. Maybe consequently, people did not perceive the INMI experiences irritating.

Questionnaire studies of INMI started in small scale. The validity and reliability of questionnaire studies of INMI was indirectly addressed by Beaman and Williams (2010) by

comparing a set 103 filled surveys to the diary data described above. They found a high level of convergence in results, but with some reporting bias associated with the questionnaire, particularly tendency to exaggerate the duration of the INMI episodes in the questionnaire.

The next methodological development involved a large scale cross-sectional survey. This approach had been previously tested in small scale, but no published data was available until 2007 when Liikkanen (reported in Liikkanen 2012) gathered INMI reports from over 10,000 people in Finland over the Internet. He found that almost 90% of respondents experienced INMI every week. This music is typically contemporary, lyrical, and represents a fraction of a song. The frequency and characteristics of the experience are influenced by age, gender and musical dispositions.

Within the same set of data, Liikkanen (2012) also incorporated the first published attempt to induce INMI using a variation of musical image scanning task (Halpern 1988). His results were promising, as respondents repeatedly reported INMI experiences after a break following the induction procedure. He found that familiarity was necessary but not adequate condition for the emergence of INMI and the relative freshness of the song seemed important for its later induction. Theoretically, this could be interpreted in the framework of activation of memory networks (Anderson 1983; Kvavilashvili and Mandler 2004) in which the repeated activation of the same representations would facilitate their later, intentional or unintentional, experience of music.

The most recent study of involuntary music to appear was authored by Williamson and associates (Williamson, Jilka et al. 2012). They investigated the conditions which trigger INMI experiences in a data set consisted of 604 entries submitted through different Internet sites in an open-ended format. They identified several re-occurring themes in the descriptions of the onset of the experience. *Exposure* (recent and repeated) was the most prominent, but (cross-modal) *associations*, and *affective states* were also repeatedly mentioned by the people contributing to the data. This data is well aligned with the findings of Halpern and Bartlett (2011), who also used a small survey and a diary (N=21) and a distinct diary among forty one respondents to study INMI. Their findings showed that the experiences were frequently associated with recent music listening and occurred more than once a day.

There are also two studies of INMI from the field of consciousness studies rather than psychology, which seem relevant for understanding of normal music cognition. Brown (2006), a highly musical and trained individual, described his personal experiences with INMI as in a bit similar vein as Reik (1953) but from a theoretically more agnostic point of view. His treatment of “perpetual musical imagery” highlights the phenomenological richness of INMI. Brown describes the phenomenon as almost a parallel soundtrack to other auditory events in everyday life, sometimes accompanied by unconscious finger movements.

Wammes and Baruss (2009) continued Brown’s work by administering a questionnaire on musical imagery. In addition to music related items, they also gathered data on personality factors, similar to Kellaris’s unpublished efforts (Kellaris 2001; Kellaris 2003). They particularly used a measure of *Transliminality*, openness and sensitivity to psychological

phenomena generated by themselves. It is a composite of paranormal experiences and beliefs, ideation, creativity personality, mystical experience, manic and depressive experiences. Their data was collected from sixty seven participants. It revealed that respondents with a high transliminality scores also had more persistent, distracting, and unconscious INMI experiences than others.

## B. Involuntary music in clinical psychiatry

Phenomena of involuntary music are also evident besides population of “normal” mental life. Several conditions in neurology and psychiatry involve symptoms very much alike INMI. The whole spectrum of music related mental phenomena is even more marvellous (see Sacks 2007). Here, we consider the related features in clinical literature under three categories: *peripheral nervous system* related, *brain damage* related and *functional disease* related (Berrios 1990; although Evers and Ellger 2004 propose additional categories of intoxication and epilepsy excluded here). These three conditions are not all inclusive. A phenomenon known as *palinacousis*, auditory perseveration has also been documented (Di Dio, Fields et al. 2007; Jacobs, Feldman et al. 1973; Terao and Matsunaga 1999). This is a distinct condition related to brain damage and epilepsy. It results in a persistent auditory experience, alike to an “echoic” memory than a result auditory imagery. For instance, in the case of 49-year-old woman described by Di Dio et alia (2007), she experienced a sustaining, non-localizable echo of an auditory stimulus until another stimuli over rode it.

There are several known cases in which reduced (hypacusis) or loss of hearing triggers hallucinatory auditory perception (Cope and Baguley 2009; Griffiths 2000). This is sometimes called an auditory Charles Bonnet syndrome (Evers and Ellger 2004) or auditory release hallucinations. The common denominator with these commonly elderly people is that there otherwise minimal auditory consciousness becomes occupied with material they perceive usually hallucinatory. In some cases, this material is music. This seems to relate to a lack of excitation to auditory areas in cortex and limbic regions, as if the intact auditory cortices became hypersensitive due to sensory deprivation. (Griffiths 2000).

It has also been documented that brain damage or brain stimulation can alter normal musical processing and create experiences. For instance, a brain stem lesion induced a temporary hearing loss and accompanying musical hallucinations to a middle-aged man (Murata, Naritomi et al. 1994). The classical studies of Penfield and Perot (1963) demonstrated how the electrical stimulation of healthy subjects evoked conscious recall of memories, including music. Although sites of stimulation suggested that the specific memories reside in cortical areas associated with the nominal regions (e.g. sounds and music at temporal, auditory areas), the experiments did failed in reliable, across subject evocation of memories.

Involuntary music is commonly associated with two classes of mental illness (functional disorder): *obsessive-compulsive disorder* (OCD) and *schizophrenia*. For OCD, so called musical obsessions (Dattatreya and Chittaranjan 2009; Gomibuchi, Gomibuchi et al. 2000; Hermesh, Konas et al. 2004; Matsui, Matsunaga et al. 2003; Zungu-Dirwayi, Hugo et

al. 1999) can be an adequate criteria for diagnosis when accompanied with subjective distress and dysfunction (Stein 2002). In the few documented cases, musical obsessions have been diagnosed without any other symptoms. For instance, the two cases described by Zungu-Dirway and colleagues (1999) perceived internally created music intrusive, irritating and disrupting other thought. In another case study (Gomibuchi, Gomibuchi et al. 2000) two young students (18 & 19 years) who both suffered from disturbing musical imagery hampering everyday life.

Hallucinations are a typical symptom in *schizophrenia*, including musical ones (Griffiths, Jackson *et al.* 1997; Hermesh, Konas et al. 2004). Among the researchers studying schizophrenia, there has been a long discussion about musical hallucinations and pseudo-hallucinations (Prahraj, Goyal *et al.* 2009; van der Zwaard and Polak 2001). For instance, Terao and Ikemura (2000) refuted the aforementioned musical obsessions diagnosis (Zungu-Dirway, Hugo et al. 1999). They preferred to call the condition pseudo-hallucinations because the hallucinations (music) were perceived in the subjective space and were under limited conscious control. This discussion has not concluded and it is known OCD and schizophrenia do sometimes co-occur and have somewhat overlapping aetiology (Hermesh, Konas et al. 2004).

The importance of psychiatric investigations for INMI is quite obvious. The phenomenology of INMI and music-related mental disorders seems to have much in common. Also an interesting parallel between INMI (Liikkanen 2012) and musical hallucinations (Berrios 1990) is the female preponderance, although this is not characteristic of mental illness such as schizophrenia as such (Lera, Herrero *et al.* 2011). Overall it seems justified to claim that there is a continuum of phenomena of involuntary music, with variable degree of commonality and severity. We will later on discuss the possible dimension that could be used to differentiate INMI from more severe or debilitating forms.

### C. Involuntary music in psychoanalysis

Reik, a psychotherapist and scholar in the field, did a monograph about the function of involuntary musical memories in the service of psychoanalysis. His work was also followed by few others writing about the hidden message of music (Hannett 1964; Lipson 2006). Lipson writes about his view of how music can substitute the presence of mothering or sheltering person, making a comparison about the role of dreams in Freud's theory. He also shares Reik's conviction about the communicative nature of INMI in clinician's work.

Hannet (1964) has also studied the social, affective bonds revived in music. She did a significant job in analysing the lyrical contents of 2111 "hit songs" from the first half of 20<sup>th</sup> century. Of those, 69% were classified as romantic love songs and she continued to analyse their content. She did this according to their level of fantasy, 'ego distance' (both Freudian concepts), and thematic content. Hannet interpreted the domination of love songs as reflecting the universal need for love and passion, particularly that the popular lyrics express "unconscious infantile attitudes... or partial attachments to the image of preoedipal mother." (Hannett 1964) She further argues that the hit songs, and consequently repeated INMI

songs, reflects the "psyche" of the nation and the type of unconscious message it is currently receptive to.

In this subsection, we have not tried to cover the whole wealth of literature in the psychoanalytic tradition about involuntary music, but we believe that this already gives reader an adequate understanding of the central arguments. The importance of this line of thought for the psychological study of INMI is about the pursuit of meaning; the desire to explain why INMI experiences emerge both on specific and general level.

## III. METHOD

In this study we sought to expand the approaches to INMI by considering the *social aspects* of the phenomenon. The data was collected without any specific priming to the topic as a part of a more comprehensive study related to music (see Liikkanen 2012). In this investigation, we studied replies to an open-ended questionnaire item labelled "what else would you like to say about involuntary musical imagery?"

We screened 1229 responses for the present study. All the answers including social or interactional aspects were then selected for further analysis, a total of 75 answers. They were on average 32.8 words (sd=30.2 w.) per participant (69% females, mean age=29). A grounded theory approach was used to explore relevant, emerging themes about the role of INMI in everyday live.

## IV. RESULTS

These answers were then systematically categorized by their qualitative content. We were discovered two convergent themes associated with the social aspects. These themes were *collective contagion* and *locus of attention* (Figure 1). We will next explain them with illustrative extracts from the answers. The answers have been translated from the original language (Finnish) to English by the author.

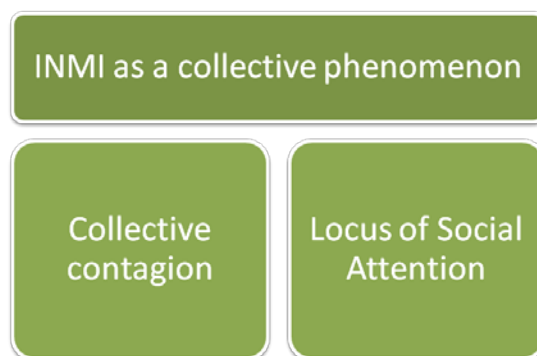


Figure 1 Themes discovered in the analysis

### A. Collective contagion

Some people were very conscious of the contagious properties of music. Three different types of experiences with social implications were found within the answers: *contagion games*, *intentional priming attempts*, and *serendipitous co-experiences*.

The game aspect was revealed by a participant describing a close social relationship in which both parties were clearly very conscious of the dynamics of INMI:

*"With my brother, we sometimes try to 'infect' the other one with a song. So, if a song was playing in one's head, you would sing it aloud and get a point if the other one starts singing or humming the same song with noticing it. We try to see how easy is it to spread a song."*  
Participant # 596

The gaming experiences were rare, but intentional priming attempts were not so. In these cases, the person with an earworm would try to "pass the earworm" to a receptive person. Several people seemed to be aware of this possibility and we believe they considered it to be a socially acceptable type of having fun:

*"In the tour bus, we exercise 'infecting' irritating songs to other one's heads. Sometimes it pisses us off."*  
Participant # 739

Serendipitous co-experiences of INMI also gathered some attention. This describes experiences in which person has or is experiencing INMI and shares this experience with someone only to realize that the other person is also experiencing a similar INMI! An example from a couple:

*"A chorus from a new, charts hit could be playing in my boyfriend's head. We could start singing the chorus at the same from the same place by accident."*  
Participant # 603

## B. Locus of Social Attention

Although INMI is foremost a private experience, people reported a number of instances in which the inner music became the locus of overt attention. In these cases, person's inattentive involuntary music becomes overtly expressed by singing, humming, drumming, or other rhythmic movement, drawing other people's attention to the performer. This only becomes an issue because the participants report this perceived this attention as a negative, unwanted consequence.

*"Sometimes a song might be going on for several days all the time, day and night, and without noticing, you sing along aloud. One time at my working place I think was just singing that 'If you touch me one more time I will do you in'."*  
Participant # 156

This can be understood against the specific cultural background. Gaining social attention in the Finnish culture, which emphasizes modesty, is not necessarily desired. Most adults do not like to draw any attention to themselves. In a culture which openly recommends "leaving music to the professionals", spontaneous amateur singers can expect to receive negative remarks about their behaviour. Overall, many had experienced socially awkward situations or were consciously trying to avoid public musical expressions which they sometimes associated with INMI, caused by it or coupled with it.

## V. DISCUSSION

In this paper we presented a new empirical angle to INMI and gone through the related literature in large. We found that INMI connects to a number of social activities through collective contagion and drawing social attention to itself. However this was not very common among the participants representing the highly musically educate Finnish culture. Findings describe INMI, but they are not generalizable. The respondents, and responses, were highly selected (cf. Liikkanen 2012). What this data demonstrates is the possible scope and relevance of INMI to not just musical cognition but to everyday life also in social side. Although these behaviours were not very commonly reported, they reveal interesting side effects, which should be included in the conception of the big picture of INMI. The features discovered here might be typical of young people, who value, consume and practice more often, and have similarly minded friends.

### A. Future directions

What are the future directions for research on INMI? There are multiple paths for empirical research but even more pressing need for theory. In the Background section of this paper, we presented briefly the main results of published empirical studies relevant for INMI. What is lacking from the empirical literature is a clear theoretical grounding. Although all authors usually discuss the theoretical basis for the phenomenon, few have presented a clear theory on how or why INMI emerges. We also share the blame. This clearly is not a feeble challenge.

This far we have seen discussion going around two themes: cognition and affect. Regarding the former, most of the discussion revolves around concepts of memory, cues and exposure. Much of the shared understanding is based on cognitive vocabulary (cf. Anderson 1983; Kvavilashvili and Mandler 2004). The importance of affect was very much emphasized by the psychodynamic psychologists. In the context of current "general" psychology, the proper concept might that of mood regulation (Bailes 2007). We should not expect that there will be one for all explanation for INMI across different experiences. As implied by the recent studies (Williamson, Jilka et al. 2012), the triggers of INMI are sometimes identified by people and can be associated with an identifiable cause. The psychoanalysts would argue that people who have not gone through psychoanalysis are not equipped to identify the causes.

We are not worried about the psychoanalytic arguments regarding the possible short comings of self-reporting. What we find problematic about self-reporting is that even without biases, the phenomenology of INMI, "what does it mean to experience INMI", is not necessarily the same for everyone (cf. Jackson 1986). Based on anecdotal evidence and data used in this study, it seems that "normal" people also sometimes experience more vivid, if not even hallucinatory experiences. These could also include hypnagogic hallucinations in the state of consciousness between sleep and being awake (Mandler 1994). For instance, the different dimensions of imagery (Bailes 2007) are difficult to study and we do not quite understand even the variation in musical perception among non-professional musicians, which would be the foundation for understanding INMI. It is likely that there is much richer

phenomenology to INMI experiences than we have been able to capture this far, given the already discovered individual differences, for instance between people with different amounts of musical education (Liikkanen 2012).

Beyond emotion and cognition, it would be tempting to (re)visit ideas about “identifying the properties of tunes that get caught in your head.” (Kellaris 2001) Although much of the past research discourages the whole idea by showing the idiosyncrasy of INMI tunes, the idea remains lucrative. When pushed, the typical statement from a researcher to public inquiries about the nature of INMI will make a reference to known, repetitive musical structures of music facilitating its memorization and later INMI incidents. But is this so straightforward? Could there exist an undiscovered formulae to tunes most likely to create INMI. This is certainly something that many composers would love to know. In the real world context, this is a very difficult question to answer. If the cognitive, exposure hypothesis is correct, our INMI experiences are mostly dominated by what we hear. And what we typically listen to is not random samples of chord progressions, but carefully composed, produced, mixed, and mastered pieces of music aiming for the maximum impact. There is a poverty of stimulus when it comes to musical variety, making the musical properties hypothesis (cf. Liikkanen 2012) nearly impossible to test.

The cognitive neuroscience of INMI is an intriguing research direction. The methods of cognitive neuroscience have advanced tremendously since the late 1990’s when the first experiments in (voluntary) musical imagery took place. If we could just find reliable induction methods or correlates of INMI, functional brain imaging could open up whole another reality for studying INMI. This might able us to connect our theoretical work to biological psychiatry and discuss whether the lack of efferent input to auditory areas (cf. Griffiths 2000) could be underlying the emergence of INMI as well. There is some anecdotal evidence about biofeedback and subvocalization [SMITH]. These association could be investigated electrophysiologically which might open up new ways to understand both voluntary musical imagery and INMI.

What is the importance of the psychodynamic quest for the meaning of INMI? (cf. Lipson 2006) The data (Liikkanen 2012; Williamson, Jilka et al. 2012) shows that a lot of INMI experiences are associated with recent music listening, which supports a cognitive, non-semantic explanation of the phenomenon. On the other hand, there are lot of INMI experiences in which the temporal association is unclear or missing. In Williamson’s study, the number of different types of triggers identified was considerable. But it is not so clear when do we have to take in explanatory elements from psychodynamic psychology, for instance, in addition to elaborate concepts surrounding affect (mood, emotion).

## VI. CONCLUSIONS

It looks more and more like there are multiple mechanisms triggering INMI and we should not exclude explanations which make references to unconscious information processing, whether it is about emotions or something else. Our small piece of empirical data presented here suggest that INMI should be

studied as a specific instance of “involuntary music”, with an appreciation to overt behaviours and social responses to it.

Future research on INMI must reach further to increase our understanding of it, to establish a solid view of this psychological construct and its importance for cognition, emotion and behaviour. We would like to see three big questions of INMI answered: *What is the general mechanism underlying INMI? Why does a particular song become an INMI experience? How can a person regulate their INMI experiences?*

Beyond the interests of “mainstream” psychology, there is a universal interest of bridging involuntary music phenomena from psychiatry to INMI. This leads to questions, for instance, what are the dimensions on which we should try to compare these phenomena? Below

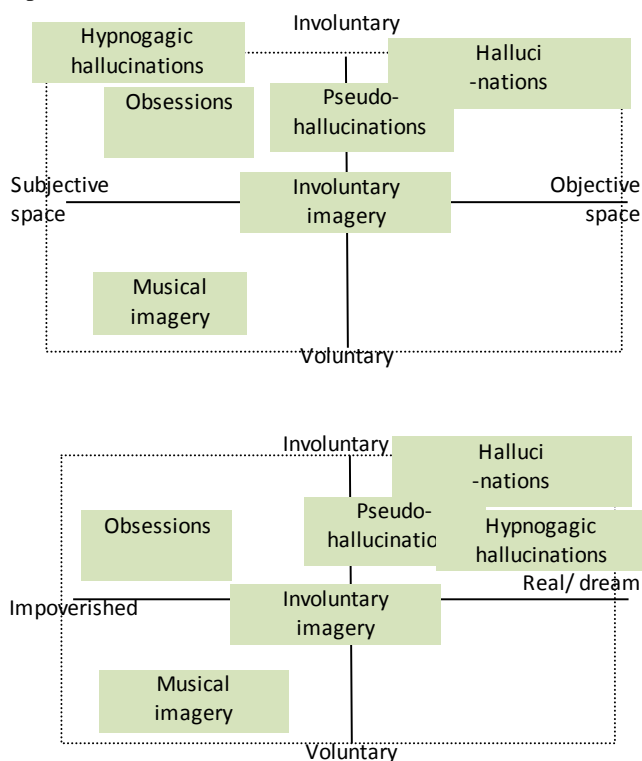


Figure 2. Two depictions of the two-dimensional space of involuntary music from “normal” to abnormal varieties.

I believe the involuntary musical imagery symposium now held for the first in association with ICMPC-ESCOM 2012 can spark lot of ideas for future research, which eventually answers the presented and to be discovered research questions.

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